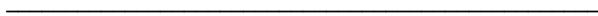


Simply fill-in the blanks of the multiplications tables.

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1		3	4	5		7		9				13	14	
2	2				10	12	14		18	20	22				30
3		6			15	18	21	24			33	36			
4	4		12	16				32		40	44	48	52	56	60
5		10			25	30		40			55				75
6			18	24	30	36	42	48						84	
7	7		21		35			56						98	
8	8	16	24	32		48	56			80	88	96	104	112	120
9	9		27			54		72	81		99			126	135
10		20								100	110				150
11		22									121		143	154	
12				48	60	72	84	96		120	132		156		180
13	13	26			65				117	130			169		195
14	14	28	42	56		84	98	112	126		154				210
15			45			90		120							

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1			4	5	6	7	8							
2	2	4	6		10	12	14	16	18	20		24			30
3				12			21		27	30	33	36			
4		8			20	24				40	44			56	
5		10					35	40					65		75
6	6		18	24	30		42	48			66			84	90
7		14	21		35	42			63				91	98	
8	8		24	32				64			88			112	120
9		18				54						108	117	126	
10	10		30	40	50		70		90		110	120			
11			33		55	66							143		
12			36	48	60		84		108	120	132				
13	13		39	52			91	104		130	143	156	169		
14	14	28		56			98		126				182		
15	15	30		60		90	105	120	135				195	210	

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1	2		4	5	6	7	8	9	10	11		13		15
2		4	6		10	12	14	16	18	20			26		
3	3			12		18		24	27			36		42	45
4	4	8		16		24		32			44				
5	5	10	15	20				40	45	50	55		65		75
6	6	12			30	36	42			60	66	72	78	84	90
7	7	14		28			49		63				91	98	
8	8		24		40		56					96		112	120
9		18	27		45	54	63	72	81	90			117	126	
10	10	20	30							100		120	130	140	150
11	11		33	44	55	66			99		121	132	143	154	165
12	12		36				84								180
13	13		39	52			91	104	117	130		156		182	195
14	14			56			98						182		
15	15			60	75	90	105	120	135	150	165		195		





Round off the numbers to the corresponding significant digits & add the numbers while maintaining columns.

Number	Significant Digits	Result
<u>0.1438755909</u>	<u>8</u>	<u>0.14387559</u>
<u>759.8066828</u>	<u>3</u>	<u>759.807</u>
<u>5956.5341</u>	<u>2</u>	<u>5956.53</u>
<u>25097.5263322777</u>	<u>7</u>	<u>25097.52633</u>
<u>0.3115163124</u>	<u>7</u>	<u>0.3115163</u>
<u>178.8799600</u>	<u>5</u>	<u>178.87996</u>
<u>3884.8118</u>	<u>3</u>	<u>3884.812</u>
<u>4964.2413523703</u>	<u>6</u>	<u>4964.241352</u>
<u>0.3709884557</u>	<u>8</u>	<u>0.37098846</u>
<u>166.5512027</u>	<u>5</u>	<u>166.5512</u>
<u>6141.7203</u>	<u>2</u>	<u>6141.72</u>
<u>3018.3424082813</u>	<u>7</u>	<u>3018.342408</u>
<u>0.5815421640</u>	<u>3</u>	<u>0.582</u>
<u>422.9295640</u>	<u>3</u>	<u>422.93</u>
<u>7975.9998</u>	<u>3</u>	<u>7976</u>
<u>7656.6800553937</u>	<u>5</u>	<u>7656.68006</u>
<u>0.5637910534</u>	<u>4</u>	<u>0.5638</u>
<u>461.0082136</u>	<u>5</u>	<u>461.00821</u>
<u>5321.5857</u>	<u>1</u>	<u>5321.6</u>
<u>70361.6251842216</u>	<u>3</u>	<u>70361.625</u>
<u>0.9691425747</u>	<u>6</u>	<u>0.969143</u>
<u>675.7245312</u>	<u>3</u>	<u>675.725</u>
<u>3448.7517</u>	<u>1</u>	<u>3448.8</u>
<u>33325.0282767377</u>	<u>7</u>	<u>33325.02828</u>
<u>0.9138405339</u>	<u>6</u>	<u>0.913841</u>
<u>3960.7477</u>	<u>2</u>	<u>3960.75</u>
<u>14927.0162161041</u>	<u>7</u>	<u>14927.01622</u>

Add the following groups of numbers.

3	5	7	7	9	7	7	9	8	8	6	6	6		
		8	6	4	7	.	2	4	3	4	5	1	1	4
	4	7	7	5	2	.	5	4	8	3	5	5	4	7
	3	3	1	6	6	.	1	3	9	8	9	9	2	2
				9	4	9	.	3	3	9	4	3	0	3
					5	2	.	3	4	8	1	8	1	4
	3	9	7	2	4	.	2	6	5	4	7	1	8	3
				9	8	6	.	9	5	4	8	6	8	5
						6	.	3	8	0	8	8	2	8
		7	8	6	9	.	3	3	3	8	0	1	0	4
		3	5	5	7	.	3	0	2	3	5	1	3	4
	9	1	6	2	8	.	6	9	9	5	5	8	3	5
	2	8	1	6	6	.	6	1	5	6	6	6	2	3
	4	2	5	6	7	.	4	4	8	7	2	6	9	4
				4	5	4	.	8	6	6	1	4	2	9
					3	4	.	5	3	4	3	4	6	2
	+													
	3	0	5	5	6	4	0	2	1	1	3	3	9	1
3	4	5	6	9	5	6	6	8	5	8	8	8		
		1	7	7	6	.	7	8	7	5	0	8	7	2
	4	7	1	3	3	.	3	4	2	0	0	5	3	4
	1	2	7	8	6	.	3	0	3	8	4	4	2	2
				4	1	7	.	6	4	6	4	3	7	5
					4	9	.	8	2	1	3	8	2	7
	7	6	4	3	7	.	0	3	0	0	4	9	0	6
				4	8	5	.	5	8	6	9	0	9	6
						6	.	5	3	0	5	5	5	9
		1	4	1	6	.	0	3	0	7	2	8	9	6
		7	2	8	5	.	4	5	8	8	7	1	8	4
		9	5	3	6	.	2	5	3	9	5	4	5	7
	8	3	4	9	6	.	0	1	2	8	0	8	6	8
	8	3	8	1	5	.	0	1	5	4	8	2	3	7
				1	1	7	.	1	3	6	1	3	6	5
	+				2	4	.	4	9	7	6	1	1	8
	3	2	4	7	8	3	4	5	4	2	8	7	7	7
2	6	7	6	6	5	8	6	6	7	6	8	6		
		2	3	1	7	.	0	5	6	2	4	1	0	3
		8	1	2	0	.	7	9	2	8	2	1	6	1
		8	8	1	0	.	6	7	5	4	3	5	7	2
			8	8	8	.	2	6	0	9	5	7	2	5
				3	1	.	1	5	9	3	7	7	6	6
		7	6	4	4	.	3	1	9	0	3	2	9	3
			7	8	2	.	3	7	2	5	2	7	9	7
					9	.	1	1	1	4	9	1	0	6
	6	8	9	2	0	.	6	1	1	2	6	9	7	5
		8	4	2	8	.	2	6	3	3	5	1	0	3
	9	4	8	9	0	.	2	5	4	2	2	0	7	2
		8	3	6	8	.	1	3	2	6	2	6	8	6
		7	8	2	1	.	3	1	4	1	7	7	5	1
			6	9	8	.	9	8	6	9	6	2	7	8
	+				5	7	.	3	9	9	1	4	4	6
	2	1	7	7	8	8	7	0	9	6	3	8	5	6

This sheet should be answered **WITHOUT** the help of a calculator. Add the tenths column first and carry numbers over to the next column as necessary.

$\begin{array}{r} 11.2 \\ + 25.2 \\ \hline \end{array}$	$\begin{array}{r} 3.8 \\ + 86.3 \\ \hline \end{array}$	$\begin{array}{r} 42.0 \\ + 13.3 \\ \hline \end{array}$	$\begin{array}{r} 84.1 \\ + 10.1 \\ \hline \end{array}$	$\begin{array}{r} 99.8 \\ + 48.7 \\ \hline \end{array}$	$\begin{array}{r} 33.2 \\ + 28.3 \\ \hline \end{array}$	$\begin{array}{r} 80.0 \\ + 52.2 \\ \hline \end{array}$
$\begin{array}{r} 51.0 \\ + 53.4 \\ \hline \end{array}$	$\begin{array}{r} 42.0 \\ + 24.5 \\ \hline \end{array}$	$\begin{array}{r} 2.8 \\ + 6.0 \\ \hline \end{array}$	$\begin{array}{r} 0.6 \\ + 57.4 \\ \hline \end{array}$	$\begin{array}{r} 32.2 \\ + 56.2 \\ \hline \end{array}$	$\begin{array}{r} 23.2 \\ + 26.7 \\ \hline \end{array}$	$\begin{array}{r} 67.0 \\ + 7.2 \\ \hline \end{array}$
$\begin{array}{r} 70.9 \\ + 47.6 \\ \hline \end{array}$	$\begin{array}{r} 35.7 \\ + 60.5 \\ \hline \end{array}$	$\begin{array}{r} 44.9 \\ + 60.9 \\ \hline \end{array}$	$\begin{array}{r} 83.3 \\ + 48.9 \\ \hline \end{array}$	$\begin{array}{r} 27.4 \\ + 29.1 \\ \hline \end{array}$	$\begin{array}{r} 3.1 \\ + 16.5 \\ \hline \end{array}$	$\begin{array}{r} 92.2 \\ + 87.6 \\ \hline \end{array}$
$\begin{array}{r} 58.5 \\ + 90.9 \\ \hline \end{array}$	$\begin{array}{r} 17.6 \\ + 16.8 \\ \hline \end{array}$	$\begin{array}{r} 42.3 \\ + 19.2 \\ \hline \end{array}$	$\begin{array}{r} 36.6 \\ + 47.7 \\ \hline \end{array}$	$\begin{array}{r} 96.4 \\ + 50.7 \\ \hline \end{array}$	$\begin{array}{r} 63.9 \\ + 93.4 \\ \hline \end{array}$	$\begin{array}{r} 51.2 \\ + 89.7 \\ \hline \end{array}$
$\begin{array}{r} 82.4 \\ + 32.0 \\ \hline \end{array}$	$\begin{array}{r} 2.8 \\ + 69.9 \\ \hline \end{array}$	$\begin{array}{r} 9.8 \\ + 94.9 \\ \hline \end{array}$	$\begin{array}{r} 78.9 \\ + 18.3 \\ \hline \end{array}$	$\begin{array}{r} 14.9 \\ + 80.5 \\ \hline \end{array}$	$\begin{array}{r} 45.7 \\ + 74.8 \\ \hline \end{array}$	$\begin{array}{r} 46.2 \\ + 14.9 \\ \hline \end{array}$
$\begin{array}{r} 72.4 \\ + 77.8 \\ \hline \end{array}$	$\begin{array}{r} 8.7 \\ + 0.5 \\ \hline \end{array}$	$\begin{array}{r} 100.0 \\ + 68.1 \\ \hline \end{array}$	$\begin{array}{r} 69.6 \\ + 17.6 \\ \hline \end{array}$	$\begin{array}{r} 53.5 \\ + 14.5 \\ \hline \end{array}$	$\begin{array}{r} 42.2 \\ + 98.8 \\ \hline \end{array}$	$\begin{array}{r} 83.9 \\ + 81.2 \\ \hline \end{array}$
$\begin{array}{r} 30.8 \\ + 61.3 \\ \hline \end{array}$	$\begin{array}{r} 42.1 \\ + 37.6 \\ \hline \end{array}$	$\begin{array}{r} 74.4 \\ + 49.3 \\ \hline \end{array}$	$\begin{array}{r} 72.8 \\ + 62.8 \\ \hline \end{array}$	$\begin{array}{r} 38.6 \\ + 37.2 \\ \hline \end{array}$	$\begin{array}{r} 88.0 \\ + 30.9 \\ \hline \end{array}$	$\begin{array}{r} 62.7 \\ + 24.5 \\ \hline \end{array}$
$\begin{array}{r} 25.4 \\ + 22.9 \\ \hline \end{array}$	$\begin{array}{r} 9.5 \\ + 77.3 \\ \hline \end{array}$	$\begin{array}{r} 12.4 \\ + 37.1 \\ \hline \end{array}$	$\begin{array}{r} 95.4 \\ + 34.8 \\ \hline \end{array}$	$\begin{array}{r} 66.4 \\ + 14.0 \\ \hline \end{array}$	$\begin{array}{r} 14.6 \\ + 1.6 \\ \hline \end{array}$	$\begin{array}{r} 36.3 \\ + 10.1 \\ \hline \end{array}$

Subtract the tenths column first and borrow numbers from the column to the left as necessary.

$\begin{array}{r} 157.7 \\ - 97.3 \\ \hline \end{array}$	$\begin{array}{r} 24.0 \\ - 13.8 \\ \hline \end{array}$	$\begin{array}{r} 63.3 \\ - 48.0 \\ \hline \end{array}$	$\begin{array}{r} 67.6 \\ - 30.5 \\ \hline \end{array}$	$\begin{array}{r} 88.0 \\ - 12.6 \\ \hline \end{array}$	$\begin{array}{r} 97.2 \\ - 26.1 \\ \hline \end{array}$	$\begin{array}{r} 117.8 \\ - 28.3 \\ \hline \end{array}$
$\begin{array}{r} 115.5 \\ - 58.6 \\ \hline \end{array}$	$\begin{array}{r} 144.0 \\ - 94.4 \\ \hline \end{array}$	$\begin{array}{r} 171.8 \\ - 91.8 \\ \hline \end{array}$	$\begin{array}{r} 68.2 \\ - 11.7 \\ \hline \end{array}$	$\begin{array}{r} 129.4 \\ - 74.6 \\ \hline \end{array}$	$\begin{array}{r} 72.3 \\ - 13.9 \\ \hline \end{array}$	$\begin{array}{r} 106.3 \\ - 24.6 \\ \hline \end{array}$
$\begin{array}{r} 73.3 \\ - 1.4 \\ \hline \end{array}$	$\begin{array}{r} 106.9 \\ - 55.8 \\ \hline \end{array}$	$\begin{array}{r} 12.2 \\ - 6.0 \\ \hline \end{array}$	$\begin{array}{r} 107.2 \\ - 56.4 \\ \hline \end{array}$	$\begin{array}{r} 168.2 \\ - 81.9 \\ \hline \end{array}$	$\begin{array}{r} 41.7 \\ - 31.3 \\ \hline \end{array}$	$\begin{array}{r} 66.1 \\ - 48.8 \\ \hline \end{array}$
$\begin{array}{r} 98.9 \\ - 15.8 \\ \hline \end{array}$	$\begin{array}{r} 89.3 \\ - 34.1 \\ \hline \end{array}$	$\begin{array}{r} 120.3 \\ - 84.9 \\ \hline \end{array}$	$\begin{array}{r} 161.8 \\ - 87.9 \\ \hline \end{array}$	$\begin{array}{r} 94.8 \\ - 34.6 \\ \hline \end{array}$	$\begin{array}{r} 91.2 \\ - 18.2 \\ \hline \end{array}$	$\begin{array}{r} 47.2 \\ - 36.2 \\ \hline \end{array}$
$\begin{array}{r} 105.7 \\ - 59.4 \\ \hline \end{array}$	$\begin{array}{r} 96.4 \\ - 54.0 \\ \hline \end{array}$	$\begin{array}{r} 14.2 \\ - 9.7 \\ \hline \end{array}$	$\begin{array}{r} 116.6 \\ - 35.1 \\ \hline \end{array}$	$\begin{array}{r} 112.9 \\ - 88.0 \\ \hline \end{array}$	$\begin{array}{r} 44.6 \\ - 0.2 \\ \hline \end{array}$	$\begin{array}{r} 74.4 \\ - 63.5 \\ \hline \end{array}$
$\begin{array}{r} 83.0 \\ - 16.8 \\ \hline \end{array}$	$\begin{array}{r} 173.1 \\ - 95.6 \\ \hline \end{array}$	$\begin{array}{r} 120.5 \\ - 52.7 \\ \hline \end{array}$	$\begin{array}{r} 114.1 \\ - 75.9 \\ \hline \end{array}$	$\begin{array}{r} 146.3 \\ - 86.7 \\ \hline \end{array}$	$\begin{array}{r} 9.5 \\ - 0.9 \\ \hline \end{array}$	$\begin{array}{r} 116.2 \\ - 48.5 \\ \hline \end{array}$
$\begin{array}{r} 122.3 \\ - 78.3 \\ \hline \end{array}$	$\begin{array}{r} 102.1 \\ - 60.5 \\ \hline \end{array}$	$\begin{array}{r} 155.5 \\ - 65.7 \\ \hline \end{array}$	$\begin{array}{r} 107.3 \\ - 98.9 \\ \hline \end{array}$	$\begin{array}{r} 89.6 \\ - 28.0 \\ \hline \end{array}$	$\begin{array}{r} 123.4 \\ - 68.0 \\ \hline \end{array}$	$\begin{array}{r} 59.2 \\ - 15.4 \\ \hline \end{array}$

This sheet should be answered **WITHOUT** the help of a calculator. Add the tenths column first and carry numbers over to the next column as necessary.

11.2	3.8	42.0	84.1	99.8	33.2	80.0
+ 25.2	+ 86.3	+ 13.3	+ 10.1	+ 48.7	+ 28.3	+ 52.2
<u>36.4</u>	<u>90.1</u>	<u>55.3</u>	<u>94.2</u>	<u>148.5</u>	<u>61.5</u>	<u>132.2</u>
51.0	42.0	2.8	0.6	32.2	23.2	67.0
+ 53.4	+ 24.5	+ 6.0	+ 57.4	+ 56.2	+ 26.7	+ 7.2
<u>104.4</u>	<u>66.5</u>	<u>8.8</u>	<u>58.0</u>	<u>88.4</u>	<u>49.9</u>	<u>74.2</u>
70.9	35.7	44.9	83.3	27.4	3.1	92.2
+ 47.6	+ 60.5	+ 60.9	+ 48.9	+ 29.1	+ 16.5	+ 87.6
<u>118.5</u>	<u>96.2</u>	<u>105.8</u>	<u>132.2</u>	<u>56.5</u>	<u>19.6</u>	<u>179.8</u>
58.5	17.6	42.3	36.6	96.4	63.9	51.2
+ 90.9	+ 16.8	+ 19.2	+ 47.7	+ 50.7	+ 93.4	+ 89.7
<u>149.4</u>	<u>34.4</u>	<u>61.5</u>	<u>84.3</u>	<u>147.1</u>	<u>157.3</u>	<u>140.9</u>
82.4	2.8	9.8	78.9	14.9	45.7	46.2
+ 32.0	+ 69.9	+ 94.9	+ 18.3	+ 80.5	+ 74.8	+ 14.9
<u>114.4</u>	<u>72.7</u>	<u>104.7</u>	<u>97.2</u>	<u>95.4</u>	<u>120.5</u>	<u>61.1</u>
72.4	8.7	100.0	69.6	53.5	42.2	83.9
+ 77.8	+ 0.5	+ 68.1	+ 17.6	+ 14.5	+ 98.8	+ 81.2
<u>150.2</u>	<u>9.2</u>	<u>168.1</u>	<u>87.2</u>	<u>68.0</u>	<u>141.0</u>	<u>165.1</u>
30.8	42.1	74.4	72.8	38.6	88.0	62.7
+ 61.3	+ 37.6	+ 49.3	+ 62.8	+ 37.2	+ 30.9	+ 24.5
<u>92.1</u>	<u>79.7</u>	<u>123.7</u>	<u>135.6</u>	<u>75.8</u>	<u>118.9</u>	<u>87.2</u>
25.4	9.5	12.4	95.4	66.4	14.6	36.3
+ 22.9	+ 77.3	+ 37.1	+ 34.8	+ 14.0	+ 1.6	+ 10.1
<u>48.3</u>	<u>86.8</u>	<u>49.5</u>	<u>130.2</u>	<u>80.4</u>	<u>16.2</u>	<u>46.4</u>

Subtract the tenths column first and borrow numbers from the column to the left as necessary.

157.7	24.0	63.3	67.6	88.0	97.2	117.8
- 97.3	- 13.8	- 48.0	- 30.5	- 12.6	- 26.1	- 28.3
<u>60.4</u>	<u>10.2</u>	<u>15.3</u>	<u>37.1</u>	<u>75.4</u>	<u>71.1</u>	<u>89.5</u>
115.5	144.0	171.8	68.2	129.4	72.3	106.3
- 58.6	- 94.4	- 91.8	- 11.7	- 74.6	- 13.9	- 24.6
<u>56.9</u>	<u>49.6</u>	<u>80.0</u>	<u>56.5</u>	<u>54.8</u>	<u>58.4</u>	<u>81.7</u>
73.3	106.9	12.2	107.2	168.2	41.7	66.1
- 1.4	- 55.8	- 6.0	- 56.4	- 81.9	- 31.3	- 48.8
<u>71.9</u>	<u>51.1</u>	<u>6.2</u>	<u>50.8</u>	<u>86.3</u>	<u>10.4</u>	<u>17.3</u>
98.9	89.3	120.3	161.8	94.8	91.2	47.2
- 15.8	- 34.1	- 84.9	- 87.9	- 34.6	- 18.2	- 36.2
<u>83.1</u>	<u>55.2</u>	<u>35.4</u>	<u>73.9</u>	<u>60.2</u>	<u>73.0</u>	<u>11.0</u>
105.7	96.4	14.2	116.6	112.9	44.6	74.4
- 59.4	- 54.0	- 9.7	- 35.1	- 88.0	- 0.2	- 63.5
<u>46.3</u>	<u>42.4</u>	<u>4.5</u>	<u>81.5</u>	<u>24.9</u>	<u>44.4</u>	<u>10.9</u>
83.0	173.1	120.5	114.1	146.3	9.5	116.2
- 16.8	- 95.6	- 52.7	- 75.9	- 86.7	- 0.9	- 48.5
<u>66.2</u>	<u>77.5</u>	<u>67.8</u>	<u>38.2</u>	<u>59.6</u>	<u>8.6</u>	<u>67.7</u>
122.3	102.1	155.5	107.3	89.6	123.4	59.2
- 78.3	- 60.5	- 65.7	- 98.9	- 28.0	- 68.0	- 15.4
<u>44.0</u>	<u>41.6</u>	<u>89.8</u>	<u>8.4</u>	<u>61.6</u>	<u>55.4</u>	<u>43.8</u>

Set up ratios based on the following relationships and then cross-multiply to solve for X.

8.2	is to	6.9
as X	is to	2.7

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

8.0	is to	8
as X	is to	9.3

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

5.9	is to	6.2
as X	is to	4.3

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

4.9	is to	8
as X	is to	3.1

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

8.2	is to	9.7
as X	is to	6.4

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

3.8	is to	4.5
as X	is to	8.4

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

2.8	is to	2.3
as X	is to	5.8

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

5.4	is to	3.4
as X	is to	10

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

7.2	is to	4.8
as X	is to	4.9

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

7.4	is to	8.2
as X	is to	3.2

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

6.4	is to	8.2
as X	is to	9.2

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

3.9	is to	9.7
as X	is to	7.1

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

4.7	is to	4.3
as X	is to	1.7

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

3.1	is to	5.7
as X	is to	6.9

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

6.0	is to	8.6
as X	is to	5.4

---


$$\underline{\hspace{2cm}} = \frac{X}{\underline{\hspace{2cm}}}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

Set up ratios based on the following relationships and then cross-multiply to solve for X.

8.2 is to 6.9  
as X is to 2.7

$$\frac{8.2}{6.9} = \frac{X}{2.7}$$

$$X = \frac{8.2 \times 2.7}{6.9}$$

$$X = 3.2$$

8.0 is to 8  
as X is to 9.3

$$\frac{8.0}{8} = \frac{X}{9.3}$$

$$X = \frac{8 \times 9.3}{8}$$

$$X = 9.3$$

5.9 is to 6.2  
as X is to 4.3

$$\frac{5.9}{6.2} = \frac{X}{4.3}$$

$$X = \frac{5.9 \times 4.3}{6.2}$$

$$X = 4.1$$

4.9 is to 8  
as X is to 3.1

$$\frac{4.9}{8} = \frac{X}{3.1}$$

$$X = \frac{4.9 \times 3.1}{8}$$

$$X = 1.9$$

8.2 is to 9.7  
as X is to 6.4

$$\frac{8.2}{9.7} = \frac{X}{6.4}$$

$$X = \frac{8.2 \times 6.4}{9.7}$$

$$X = 5.4$$

3.8 is to 4.5  
as X is to 8.4

$$\frac{3.8}{4.5} = \frac{X}{8.4}$$

$$X = \frac{3.8 \times 8.4}{4.5}$$

$$X = 7.1$$

2.8 is to 2.3  
as X is to 5.8

$$\frac{2.8}{2.3} = \frac{X}{5.8}$$

$$X = \frac{2.8 \times 5.8}{2.3}$$

$$X = 7.1$$

5.4 is to 3.4  
as X is to 10

$$\frac{5.4}{3.4} = \frac{X}{10}$$

$$X = \frac{5.4 \times 10}{3.4}$$

$$X = 15.9$$

7.2 is to 4.8  
as X is to 4.9

$$\frac{7.2}{4.8} = \frac{X}{4.9}$$

$$X = \frac{7.2 \times 4.9}{4.8}$$

$$X = 7.4$$

7.4 is to 8.2  
as X is to 3.2

$$\frac{7.4}{8.2} = \frac{X}{3.2}$$

$$X = \frac{7.4 \times 3.2}{8.2}$$

$$X = 2.9$$

6.4 is to 8.2  
as X is to 9.2

$$\frac{6.4}{8.2} = \frac{X}{9.2}$$

$$X = \frac{6.4 \times 9.2}{8.2}$$

$$X = 7.2$$

3.9 is to 9.7  
as X is to 7.1

$$\frac{3.9}{9.7} = \frac{X}{7.1}$$

$$X = \frac{3.9 \times 7.1}{9.7}$$

$$X = 2.9$$

4.7 is to 4.3  
as X is to 1.7

$$\frac{4.7}{4.3} = \frac{X}{1.7}$$

$$X = \frac{4.7 \times 1.7}{4.3}$$

$$X = 1.9$$

3.1 is to 5.7  
as X is to 6.9

$$\frac{3.1}{5.7} = \frac{X}{6.9}$$

$$X = \frac{3.1 \times 6.9}{5.7}$$

$$X = 3.8$$

6.0 is to 8.6  
as X is to 5.4

$$\frac{6.0}{8.6} = \frac{X}{5.4}$$

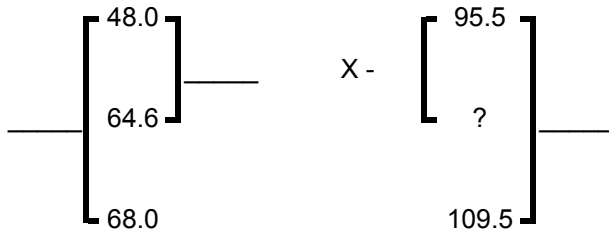
$$X = \frac{6 \times 5.4}{8.6}$$

$$X = 3.8$$



Interpolate between the given corresponding numbers to find the ?

48.0	95.5
64.6	?
68.0	109.5



\_\_\_\_\_ is to \_\_\_\_\_ as X is to \_\_\_\_\_

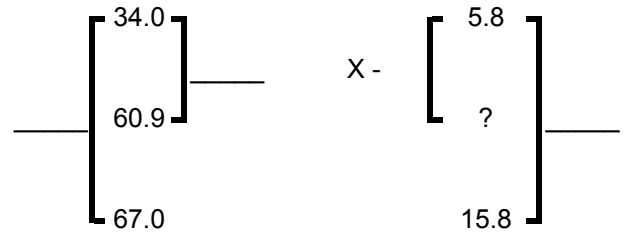
$$\frac{\quad}{\quad} = \frac{\quad}{\quad}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

$$? = \underline{\hspace{2cm}}$$

34.0	5.8
60.9	?
67.0	15.8



\_\_\_\_\_ is to \_\_\_\_\_ as X is to \_\_\_\_\_

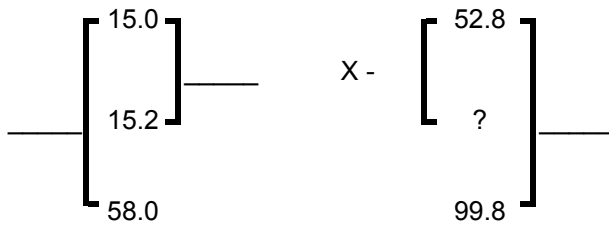
$$\frac{\quad}{\quad} = \frac{\quad}{\quad}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

$$? = \underline{\hspace{2cm}}$$

15.0	52.8
15.2	?
58.0	99.8



\_\_\_\_\_ is to \_\_\_\_\_ as X is to \_\_\_\_\_

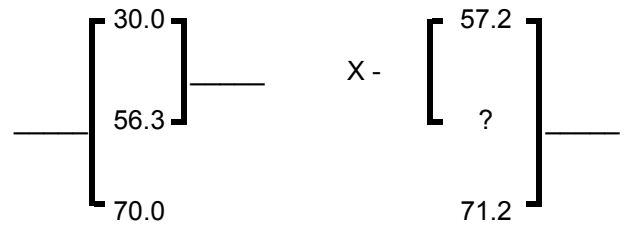
$$\frac{\quad}{\quad} = \frac{\quad}{\quad}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

$$? = \underline{\hspace{2cm}}$$

30.0	57.2
56.3	?
70.0	71.2



\_\_\_\_\_ is to \_\_\_\_\_ as X is to \_\_\_\_\_

$$\frac{\quad}{\quad} = \frac{\quad}{\quad}$$

$$X = \underline{\hspace{2cm}}$$

$$X = \underline{\hspace{2cm}}$$

$$? = \underline{\hspace{2cm}}$$

Interpolate between the given corresponding numbers to find the ?

48.0	95.5
64.6	?
68.0	109.5

$$20 - \begin{bmatrix} 48.0 \\ 64.6 \\ 68.0 \end{bmatrix} - 16.6 \quad X - \begin{bmatrix} 95.5 \\ ? \\ 109.5 \end{bmatrix} - 14$$

16.6 is to 20 as X is to 14.0

$$\frac{16.6}{20} = \frac{X}{14}$$

$$X = \frac{16.6 \times 14}{20}$$

$$X = 11.6$$

$$? = 107.1$$

34.0	5.8
60.9	?
67.0	15.8

$$33 - \begin{bmatrix} 34.0 \\ 60.9 \\ 67.0 \end{bmatrix} - 26.9 \quad X - \begin{bmatrix} 5.8 \\ ? \\ 15.8 \end{bmatrix} - 10$$

26.9 is to 33 as X is to 10.0

$$\frac{26.9}{33} = \frac{X}{10}$$

$$X = \frac{26.9 \times 10}{33}$$

$$X = 8.2$$

$$? = 14$$

15.0	52.8
15.2	?
58.0	99.8

$$43 - \begin{bmatrix} 15.0 \\ 15.2 \\ 58.0 \end{bmatrix} - 0.2 \quad X - \begin{bmatrix} 52.8 \\ ? \\ 99.8 \end{bmatrix} - 47$$

0.2 is to 43 as X is to 47.0

$$\frac{0.2}{43} = \frac{X}{47}$$

$$X = \frac{0.2 \times 47}{43}$$

$$X = 0.2$$

$$? = 53$$

30.0	57.2
56.3	?
70.0	71.2

$$40 - \begin{bmatrix} 30.0 \\ 56.3 \\ 70.0 \end{bmatrix} - 26.3 \quad X - \begin{bmatrix} 57.2 \\ ? \\ 71.2 \end{bmatrix} - 14$$

26.3 is to 40 as X is to 14.0

$$\frac{26.3}{40} = \frac{X}{14}$$

$$X = \frac{26.3 \times 14}{40}$$

$$X = 9.2$$

$$? = 66.4$$

Simply fill-in the blanks.

tenths of hours	minutes of time
0	00
0.05	03
0.1	06
0.15	09
0.2	12
0.25	15
0.3	18
0.35	21
0.4	24
0.45	27
0.5	30
0.55	33
0.6	36
0.65	39
0.7	42
0.75	45
0.8	48
0.85	51
0.9	54
1	60

minutes of time	tenths of hours
45	_____
30	_____
24	_____
15	_____
33	_____
3	_____
15	_____
0	_____
54	_____
51	_____
30	_____
33	_____
9	_____
27	_____
12	_____
57	_____
12	_____
42	_____
42	_____
12	_____
18	_____
33	_____
54	_____
9	_____
42	_____
24	_____
42	_____
39	_____
15	_____
21	_____
51	_____

minutes of time	tenths of hours	tenths of hours	minutes of time	hours & minutes	hours & tenths	degrees & minutes	degrees & tenths
18	_____	0.55	_____	19 21	_____	128° - 51'	_____
33	_____	0.95	_____	19 03	_____	123° - 45'	_____
21	_____	0.15	_____	03 39	_____	118° - 18'	_____
39	_____	0.25	_____	04 12	_____	016° - 36'	_____
21	_____	0.2	_____	07 39	_____	124° - 54'	_____
42	_____	0.3	_____	18 18	_____	054° - 12'	_____
30	_____	0.15	_____	06 09	_____	164° - 06'	_____
33	_____	0.85	_____	06 30	_____	035° - 36'	_____
48	_____	0.2	_____	21 45	_____	113° - 27'	_____
45	_____	0.6	_____	02 36	_____	092° - 30'	_____
27	_____	0.35	_____	08 03	_____	174° - 51'	_____
6	_____	0.1	_____	08 03	_____	172° - 18'	_____
24	_____	0.7	_____	20 00	_____	085° - 00'	_____
36	_____	0.9	_____	18 45	_____	063° - 48'	_____
0	_____	0.75	_____	04 12	_____	075° - 15'	_____
12	_____	0.9	_____	23 09	_____	151° - 39'	_____
18	_____	0.75	_____	00 09	_____	153° - 00'	_____
12	_____	0.55	_____	17 30	_____	102° - 39'	_____
48	_____	0.2	_____	08 51	_____	022° - 18'	_____
51	_____	0.75	_____	00 45	_____	100° - 15'	_____
48	_____	0.45	_____	17 27	_____	100° - 00'	_____
24	_____	0.4	_____	21 06	_____	092° - 27'	_____
9	_____	0.25	_____	12 06	_____	139° - 03'	_____
33	_____	0.2	_____	20 33	_____	080° - 57'	_____
3	_____	0.9	_____	12 57	_____	050° - 27'	_____
27	_____	0.55	_____	19 24	_____	113° - 24'	_____
36	_____	0.9	_____	16 24	_____	116° - 42'	_____
12	_____	0.6	_____	20 57	_____	115° - 51'	_____
51	_____	0.3	_____	23 27	_____	088° - 39'	_____
48	_____	0.45	_____	12 42	_____	060° - 57'	_____
18	_____	0.4	_____	07 03	_____	033° - 48'	_____
45	_____	0.45	_____	09 39	_____	127° - 21'	_____
51	_____	0.3	_____	20 45	_____	086° - 51'	_____
24	_____	0.5	_____	23 24	_____	169° - 24'	_____
54	_____	0.2	_____	10 30	_____	156° - 36'	_____
9	_____	0.3	_____	06 48	_____	024° - 42'	_____
42	_____	0.8	_____	16 09	_____	062° - 06'	_____
12	_____	0.8	_____	10 51	_____	100° - 24'	_____
18	_____	0	_____	11 15	_____	028° - 18'	_____
3	_____	0.5	_____	05 00	_____	162° - 36'	_____
0	_____	0.5	_____	23 24	_____	133° - 21'	_____
30	_____	0.1	_____	10 15	_____	045° - 51'	_____
39	_____	0.65	_____	02 15	_____	092° - 18'	_____
0	_____	0.1	_____	05 18	_____	153° - 33'	_____
3	_____	0.05	_____	16 18	_____	111° - 21'	_____
39	_____	0.95	_____	23 18	_____	094° - 45'	_____
48	_____	0.5	_____	14 00	_____	151° - 00'	_____
6	_____	0.75	_____	12 36	_____	012° - 30'	_____
21	_____	0.2	_____	17 30	_____	071° - 51'	_____
48	_____	0.35	_____	05 21	_____	009° - 36'	_____
36	_____	0.1	_____	15 48	_____	020° - 54'	_____
48	_____	0.9	_____	14 33	_____	113° - 18'	_____
21	_____	0.7	_____	02 18	_____	005° - 00'	_____
48	_____	0.35	_____	09 36	_____	076° - 21'	_____

Simply fill-in the blanks.

tenths of hours	minutes of time
0	00
0.05	03
0.1	06
0.15	09
0.2	12
0.25	15
0.3	18
0.35	21
0.4	24
0.45	27
0.5	30
0.55	33
0.6	36
0.65	39
0.7	42
0.75	45
0.8	48
0.85	51
0.9	54
1	60

minutes of time	tenths of hours
45	0.75
30	0.5
24	0.4
15	0.25
33	0.55
3	0.05
15	0.25
0	0
54	0.9
51	0.85
30	0.5
33	0.55
9	0.15
27	0.45
12	0.2
57	0.95
12	0.2
42	0.7
42	0.7
12	0.2
18	0.3
33	0.55
54	0.9
9	0.15
42	0.7
24	0.4
42	0.7
39	0.65
15	0.25
21	0.35
51	0.85

minutes of time	tenths of hours	tenths of hours	minutes of time	hours & minutes	hours & tenths	degrees & minutes	degrees & tenths
18	0.3	0.55	33	19 21	19.35	128° - 51'	128.85°
33	0.55	0.95	57	19 03	19.05	123° - 45'	123.75°
21	0.35	0.15	9	03 39	3.65	118° - 18'	118.30°
39	0.65	0.25	15	04 12	4.20	016° - 36'	016.60°
21	0.35	0.2	12	07 39	7.65	124° - 54'	124.90°
42	0.7	0.3	18	18 18	18.30	054° - 12'	054.20°
30	0.5	0.15	9	06 09	6.15	164° - 06'	164.10°
33	0.55	0.85	51	06 30	6.50	035° - 36'	035.60°
48	0.8	0.2	12	21 45	21.75	113° - 27'	113.45°
45	0.75	0.6	36	02 36	2.60	092° - 30'	092.50°
27	0.45	0.35	21	08 03	8.05	174° - 51'	174.85°
6	0.1	0.1	6	08 03	8.05	172° - 18'	172.30°
24	0.4	0.7	42	20 00	20.00	085° - 00'	085.00°
36	0.6	0.9	54	18 45	18.75	063° - 48'	063.80°
0	0	0.75	45	04 12	4.20	075° - 15'	075.25°
12	0.2	0.9	54	23 09	23.15	151° - 39'	151.65°
18	0.3	0.75	45	00 09	0.15	153° - 00'	153.00°
12	0.2	0.55	33	17 30	17.50	102° - 39'	102.65°
48	0.8	0.2	12	08 51	8.85	022° - 18'	022.30°
51	0.85	0.75	45	00 45	0.75	100° - 15'	100.25°
48	0.8	0.45	27	17 27	17.45	100° - 00'	100.00°
24	0.4	0.4	24	21 06	21.10	092° - 27'	092.45°
9	0.15	0.25	15	12 06	12.10	139° - 03'	139.05°
33	0.55	0.2	12	20 33	20.55	080° - 57'	080.95°
3	0.05	0.9	54	12 57	12.95	050° - 27'	050.45°
27	0.45	0.55	33	19 24	19.40	113° - 24'	113.40°
36	0.6	0.9	54	16 24	16.40	116° - 42'	116.70°
12	0.2	0.6	36	20 57	20.95	115° - 51'	115.85°
51	0.85	0.3	18	23 27	23.45	088° - 39'	088.65°
48	0.8	0.45	27	12 42	12.70	060° - 57'	060.95°
18	0.3	0.4	24	07 03	7.05	033° - 48'	033.80°
45	0.75	0.45	27	09 39	9.65	127° - 21'	127.35°
51	0.85	0.3	18	20 45	20.75	086° - 51'	086.85°
24	0.4	0.5	30	23 24	23.40	169° - 24'	169.40°
54	0.9	0.2	12	10 30	10.50	156° - 36'	156.60°
9	0.15	0.3	18	06 48	6.80	024° - 42'	024.70°
42	0.7	0.8	48	16 09	16.15	062° - 06'	062.10°
12	0.2	0.8	48	10 51	10.85	100° - 24'	100.40°
18	0.3	0	0	11 15	11.25	028° - 18'	028.30°
3	0.05	0.5	30	05 00	5.00	162° - 36'	162.60°
0	0	0.5	30	23 24	23.40	133° - 21'	133.35°
30	0.5	0.1	6	10 15	10.25	045° - 51'	045.85°
39	0.65	0.65	39	02 15	2.25	092° - 18'	092.30°
0	0	0.1	6	05 18	5.30	153° - 33'	153.55°
3	0.05	0.05	3	16 18	16.30	111° - 21'	111.35°
39	0.65	0.95	57	23 18	23.30	094° - 45'	094.75°
48	0.8	0.5	30	14 00	14.00	151° - 00'	151.00°
6	0.1	0.75	45	12 36	12.60	012° - 30'	012.50°
21	0.35	0.2	12	17 30	17.50	071° - 51'	071.85°
48	0.8	0.35	21	05 21	5.35	009° - 36'	009.60°
36	0.6	0.1	6	15 48	15.80	020° - 54'	020.90°
48	0.8	0.9	54	14 33	14.55	113° - 18'	113.30°
21	0.35	0.7	42	02 18	2.30	005° - 00'	005.00°
48	0.8	0.35	21	09 36	9.60	076° - 21'	076.35°

Solve for Distance or Time as needed.

$$60 D = S \times T$$

with time in minutes

$$D = S \times T$$

with time in hours

8.0	knots	0.8	1/10 the speed	S	20.0	knots	D	1141.0	nm
6	minutes	<u>x 1</u>	tenths of hours	<u>x T</u>	<u>x 2.9</u>	hours	$\div S$	$\div 25.3$	knots
			nm	D		nm	T		hours
23.0	knots	2.3	1/10 the speed	S	20.9	knots	D	984.5	nm
42	minutes	<u>x 7</u>	tenths of hours	<u>x T</u>	<u>x 2.3</u>	hours	$\div S$	$\div 11.0$	knots
			nm	D		nm	T		hours
26.0	knots	2.6	1/10 the speed	S	17.3	knots	D	945.5	nm
12	minutes	<u>x 2</u>	tenths of hours	<u>x T</u>	<u>x 3.1</u>	hours	$\div S$	$\div 22.3$	knots
			nm	D		nm	T		hours
21.0	knots	2.1	1/10 the speed	S	25.6	knots	D	1139.6	nm
6	minutes	<u>x 1</u>	tenths of hours	<u>x T</u>	<u>x 1.5</u>	hours	$\div S$	$\div 22.0$	knots
			nm	D		nm	T		hours
29.0	knots	2.9	1/10 the speed	S	27.6	knots	D	1078.6	nm
42	minutes	<u>x 7</u>	tenths of hours	<u>x T</u>	<u>x 3.8</u>	hours	$\div S$	$\div 22.9$	knots
			nm	D		nm	T		hours
20.0	knots	2.0	1/10 the speed	S	12.4	knots	D	1572.5	nm
24	minutes	<u>x 4</u>	tenths of hours	<u>x T</u>	<u>x 4.9</u>	hours	$\div S$	$\div 21.6$	knots
			nm	D		nm	T		hours
8.0	knots	0.8	1/10 the speed	S	23.5	knots	D	692.5	nm
12	minutes	<u>x 2</u>	tenths of hours	<u>x T</u>	<u>x 1.1</u>	hours	$\div S$	$\div 19.9$	knots
			nm	D		nm	T		hours
8.0	knots	0.8	1/10 the speed	S	8.1	knots	D	145.9	nm
36	minutes	<u>x 6</u>	tenths of hours	<u>x T</u>	<u>x 3.1</u>	hours	$\div S$	$\div 12.8$	knots
			nm	D		nm	T		hours
28.0	knots	2.8	1/10 the speed	S	8.8	knots	D	50.5	nm
48	minutes	<u>x 8</u>	tenths of hours	<u>x T</u>	<u>x 2.3</u>	hours	$\div S$	$\div 9.9$	knots
			nm	D		nm	T		hours
25.0	knots	2.5	1/10 the speed	S	6.6	knots	D	133.4	nm
18	minutes	<u>x 3</u>	tenths of hours	<u>x T</u>	<u>x 0.2</u>	hours	$\div S$	$\div 23.0$	knots
			nm	D		nm	T		hours
29.0	knots	2.9	1/10 the speed	S	28.2	knots	D	605.4	nm
24	minutes	<u>x 4</u>	tenths of hours	<u>x T</u>	<u>x 0.1</u>	hours	$\div S$	$\div 16.1$	knots
			nm	D		nm	T		hours
26.0	knots	2.6	1/10 the speed	S	26.8	knots	D	1502.2	nm
30	minutes	<u>x 5</u>	tenths of hours	<u>x T</u>	<u>x 3.7</u>	hours	$\div S$	$\div 26.4$	knots
			nm	D		nm	T		hours
11.0	knots	1.1	1/10 the speed	S	23.2	knots	D	390.1	nm
30	minutes	<u>x 5</u>	tenths of hours	<u>x T</u>	<u>x 5.0</u>	hours	$\div S$	$\div 6.6$	knots
			nm	D		nm	T		hours
9.0	knots	0.9	1/10 the speed	S	29.1	knots	D	575.7	nm
42	minutes	<u>x 7</u>	tenths of hours	<u>x T</u>	<u>x 0.2</u>	hours	$\div S$	$\div 21.4$	knots
			nm	D		nm	T		hours

Solve for Distance or Time as needed.

$$60 D = S \times T$$
 with time in minutes

$$D = S \times T$$
 with time in hours

8.0	knots	0.8	1/10 the speed	S	20.0	knots	D	1141.0	nm
6	minutes	<u>x 1</u>	tenths of hours	<u>x T</u>	<u>x 2.9</u>	hours	$\div S$	$\div 25.3$	knots
		0.8	nm	D	58.00	nm	T	45.1	hours
23.0	knots	2.3	1/10 the speed	S	20.9	knots	D	984.5	nm
42	minutes	<u>x 7</u>	tenths of hours	<u>x T</u>	<u>x 2.3</u>	hours	$\div S$	$\div 11.0$	knots
		16.1	nm	D	48.07	nm	T	89.5	hours
26.0	knots	2.6	1/10 the speed	S	17.3	knots	D	945.5	nm
12	minutes	<u>x 2</u>	tenths of hours	<u>x T</u>	<u>x 3.1</u>	hours	$\div S$	$\div 22.3$	knots
		5.2	nm	D	53.63	nm	T	42.4	hours
21.0	knots	2.1	1/10 the speed	S	25.6	knots	D	1139.6	nm
6	minutes	<u>x 1</u>	tenths of hours	<u>x T</u>	<u>x 1.5</u>	hours	$\div S$	$\div 22.0$	knots
		2.1	nm	D	38.40	nm	T	51.8	hours
29.0	knots	2.9	1/10 the speed	S	27.6	knots	D	1078.6	nm
42	minutes	<u>x 7</u>	tenths of hours	<u>x T</u>	<u>x 3.8</u>	hours	$\div S$	$\div 22.9$	knots
		20.3	nm	D	104.88	nm	T	47.1	hours
20.0	knots	2.0	1/10 the speed	S	12.4	knots	D	1572.5	nm
24	minutes	<u>x 4</u>	tenths of hours	<u>x T</u>	<u>x 4.9</u>	hours	$\div S$	$\div 21.6$	knots
		8.0	nm	D	60.76	nm	T	72.8	hours
8.0	knots	0.8	1/10 the speed	S	23.5	knots	D	692.5	nm
12	minutes	<u>x 2</u>	tenths of hours	<u>x T</u>	<u>x 1.1</u>	hours	$\div S$	$\div 19.9$	knots
		1.6	nm	D	25.85	nm	T	34.8	hours
8.0	knots	0.8	1/10 the speed	S	8.1	knots	D	145.9	nm
36	minutes	<u>x 6</u>	tenths of hours	<u>x T</u>	<u>x 3.1</u>	hours	$\div S$	$\div 12.8$	knots
		4.8	nm	D	25.11	nm	T	11.4	hours
28.0	knots	2.8	1/10 the speed	S	8.8	knots	D	50.5	nm
48	minutes	<u>x 8</u>	tenths of hours	<u>x T</u>	<u>x 2.3</u>	hours	$\div S$	$\div 9.9$	knots
		22.4	nm	D	20.24	nm	T	5.1	hours
25.0	knots	2.5	1/10 the speed	S	6.6	knots	D	133.4	nm
18	minutes	<u>x 3</u>	tenths of hours	<u>x T</u>	<u>x 0.2</u>	hours	$\div S$	$\div 23.0$	knots
		7.5	nm	D	1.32	nm	T	5.8	hours
29.0	knots	2.9	1/10 the speed	S	28.2	knots	D	605.4	nm
24	minutes	<u>x 4</u>	tenths of hours	<u>x T</u>	<u>x 0.1</u>	hours	$\div S$	$\div 16.1$	knots
		11.6	nm	D	2.82	nm	T	37.6	hours
26.0	knots	2.6	1/10 the speed	S	26.8	knots	D	1502.2	nm
30	minutes	<u>x 5</u>	tenths of hours	<u>x T</u>	<u>x 3.7</u>	hours	$\div S$	$\div 26.4$	knots
		13.0	nm	D	99.16	nm	T	56.9	hours
11.0	knots	1.1	1/10 the speed	S	23.2	knots	D	390.1	nm
30	minutes	<u>x 5</u>	tenths of hours	<u>x T</u>	<u>x 5.0</u>	hours	$\div S$	$\div 6.6$	knots
		5.5	nm	D	116.00	nm	T	59.1	hours
9.0	knots	0.9	1/10 the speed	S	29.1	knots	D	575.7	nm
42	minutes	<u>x 7</u>	tenths of hours	<u>x T</u>	<u>x 0.2</u>	hours	$\div S$	$\div 21.4$	knots
		6.3	nm	D	5.82	nm	T	26.9	hours

79°	to the	North	of	East	<input type="checkbox"/>		
72°	to the	South	of	West	<input type="checkbox"/>		
62°	to the	East	of	North	<input type="checkbox"/>		
9°	to the	West	of	North	<input type="checkbox"/>		
45°	to the	North	of	West	<input type="checkbox"/>		
21°	to the	South	of	East	<input type="checkbox"/>		
53°	to the	East	of	South	<input type="checkbox"/>		
51°	to the	West	of	South	<input type="checkbox"/>		
89°	to the	West	of	North	<input type="checkbox"/>		
65°	to the	East	of	North	<input type="checkbox"/>		
14°	to the	East	of	South	<input type="checkbox"/>		
6°	to the	East	of	North	<input type="checkbox"/>		
37°	to the	West	of	South	<input type="checkbox"/>		
87°	to the	East	of	South	<input type="checkbox"/>		
43°	to the	West	of	South	<input type="checkbox"/>		
80°	to the	East	of	South	<input type="checkbox"/>		
50°	to the	North	of	East	<input type="checkbox"/>		
47°	to the	South	of	East	<input type="checkbox"/>		
6°	to the	East	of	North	<input type="checkbox"/>		
13°	to the	South	of	East	<input type="checkbox"/>		
36°	to the	East	of	North	<input type="checkbox"/>		
82°	to the	East	of	North	<input type="checkbox"/>		
8°	to the	West	of	South	<input type="checkbox"/>		
42°	to the	East	of	North	<input type="checkbox"/>		
33°	to the	West	of	South	<input type="checkbox"/>		
89°	to the	East	of	North	<input type="checkbox"/>		
51°	to the	North	of	West	<input type="checkbox"/>		
27°	to the	South	of	West	<input type="checkbox"/>		
81°	to the	South	of	West	<input type="checkbox"/>		
67°	to the	North	of	East	<input type="checkbox"/>		
53°	to the	East	of	North	<input type="checkbox"/>		
42°	to the	South	of	West	<input type="checkbox"/>		
8°	to the	West	of	North	<input type="checkbox"/>		
49°	to the	East	of	South	<input type="checkbox"/>		
8°	to the	West	of	North	<input type="checkbox"/>		
14°	to the	South	of	East	<input type="checkbox"/>		
10°	to the	East	of	North	<input type="checkbox"/>		
88°	to the	North	of	East	<input type="checkbox"/>		
34°	to the	North	of	West	<input type="checkbox"/>		
44°	to the	South	of	West	<input type="checkbox"/>		
88°	to the	East	of	North	<input type="checkbox"/>		
1°	to the	West	of	South	<input type="checkbox"/>		
90°	to the	East	of	North	<input type="checkbox"/>		
31°	to the	North	of	East	<input type="checkbox"/>		
57°	to the	North	of	West	<input type="checkbox"/>		

79°	to the	North	of	East	90°	-	79°	=	11°
72°	to the	South	of	West	270°	-	72°	=	198°
62°	to the	East	of	North	0°	+	62°	=	62°
9°	to the	West	of	North	360°	-	9°	=	351°
45°	to the	North	of	West	270°	+	45°	=	315°
21°	to the	South	of	East	90°	+	21°	=	111°
53°	to the	East	of	South	180°	-	53°	=	127°
51°	to the	West	of	South	180°	+	51°	=	231°
89°	to the	West	of	North	360°	-	89°	=	271°
65°	to the	East	of	North	0°	+	65°	=	65°
14°	to the	East	of	South	180°	-	14°	=	166°
6°	to the	East	of	North	0°	+	6°	=	6°
37°	to the	West	of	South	180°	+	37°	=	217°
87°	to the	East	of	South	180°	-	87°	=	93°
43°	to the	West	of	South	180°	+	43°	=	223°
80°	to the	East	of	South	180°	-	80°	=	100°
50°	to the	North	of	East	90°	-	50°	=	40°
47°	to the	South	of	East	90°	+	47°	=	137°
6°	to the	East	of	North	0°	+	6°	=	6°
13°	to the	South	of	East	90°	+	13°	=	103°
36°	to the	East	of	North	0°	+	36°	=	36°
82°	to the	East	of	North	0°	+	82°	=	82°
8°	to the	West	of	South	180°	+	8°	=	188°
42°	to the	East	of	North	0°	+	42°	=	42°
33°	to the	West	of	South	180°	+	33°	=	213°
89°	to the	East	of	North	0°	+	89°	=	89°
51°	to the	North	of	West	270°	+	51°	=	321°
27°	to the	South	of	West	270°	-	27°	=	243°
81°	to the	South	of	West	270°	-	81°	=	189°
67°	to the	North	of	East	90°	-	67°	=	23°
53°	to the	East	of	North	0°	+	53°	=	53°
42°	to the	South	of	West	270°	-	42°	=	228°
8°	to the	West	of	North	360°	-	8°	=	352°
49°	to the	East	of	South	180°	-	49°	=	131°
8°	to the	West	of	North	360°	-	8°	=	352°
14°	to the	South	of	East	90°	+	14°	=	104°
10°	to the	East	of	North	0°	+	10°	=	10°
88°	to the	North	of	East	90°	-	88°	=	2°
34°	to the	North	of	West	270°	+	34°	=	304°
44°	to the	South	of	West	270°	-	44°	=	226°
88°	to the	East	of	North	0°	+	88°	=	88°
1°	to the	West	of	South	180°	+	1°	=	181°
90°	to the	East	of	North	0°	+	90°	=	90°
31°	to the	North	of	East	90°	-	31°	=	59°
57°	to the	North	of	West	270°	+	57°	=	327°



6° to the right of 229°	<input type="text"/>	=	<input type="text"/>
3° to the left of 312°	<input type="text"/>	=	<input type="text"/>
20° to the left of 007°	<input type="text"/>	=	<input type="text"/>
11° to the right of 360°	<input type="text"/>	=	<input type="text"/>
19° to the left of 217°	<input type="text"/>	=	<input type="text"/>
7° to the left of 105°	<input type="text"/>	=	<input type="text"/>
13° to the right of 010°	<input type="text"/>	=	<input type="text"/>
18° to the left of 002°	<input type="text"/>	=	<input type="text"/>
3° to the right of 357°	<input type="text"/>	=	<input type="text"/>
16° to the left of 337°	<input type="text"/>	=	<input type="text"/>
18° to the right of 297°	<input type="text"/>	=	<input type="text"/>
16° to the right of 355°	<input type="text"/>	=	<input type="text"/>
6° to the right of 036°	<input type="text"/>	=	<input type="text"/>
21° to the left of 011°	<input type="text"/>	=	<input type="text"/>
8° to the left of 009°	<input type="text"/>	=	<input type="text"/>
17° to the left of 289°	<input type="text"/>	=	<input type="text"/>
20° to the left of 167°	<input type="text"/>	=	<input type="text"/>
12° to the right of 355°	<input type="text"/>	=	<input type="text"/>
12° to the left of 063°	<input type="text"/>	=	<input type="text"/>
5° to the left of 113°	<input type="text"/>	=	<input type="text"/>
9° to the right of 195°	<input type="text"/>	=	<input type="text"/>
16° to the left of 076°	<input type="text"/>	=	<input type="text"/>
20° to the right of 354°	<input type="text"/>	=	<input type="text"/> or <input type="text"/>
3° to the right of 248°	<input type="text"/>	=	<input type="text"/>
5° to the right of 277°	<input type="text"/>	=	<input type="text"/>
12° to the left of 002°	<input type="text"/>	=	<input type="text"/>
11° to the left of 038°	<input type="text"/>	=	<input type="text"/>
9° to the left of 104°	<input type="text"/>	=	<input type="text"/>
8° to the right of 353°	<input type="text"/>	=	<input type="text"/> or <input type="text"/>
4° to the left of 074°	<input type="text"/>	=	<input type="text"/>
7° to the right of 059°	<input type="text"/>	=	<input type="text"/>
19° to the right of 073°	<input type="text"/>	=	<input type="text"/>
7° to the left of 090°	<input type="text"/>	=	<input type="text"/>
9° to the left of 005°	<input type="text"/>	=	<input type="text"/>
18° to the left of 178°	<input type="text"/>	=	<input type="text"/>
14° to the left of 018°	<input type="text"/>	=	<input type="text"/>
7° to the left of 344°	<input type="text"/>	=	<input type="text"/>
11° to the left of 286°	<input type="text"/>	=	<input type="text"/>
8° to the right of 275°	<input type="text"/>	=	<input type="text"/>

6° to the right	of	229°	<u>229°</u>	<u>+</u>	<u>6° = 235°</u>	
3° to the left	of	312°	<u>312°</u>	<u>-</u>	<u>3° = 309°</u>	
20° to the left	of	007°	<u>367°</u>	<u>-</u>	<u>20° = 347°</u>	*****
11° to the right	of	360°	<u>360°</u>	<u>+</u>	<u>11° = 371°</u>	or <u>011°</u>
19° to the left	of	217°	<u>217°</u>	<u>-</u>	<u>19° = 198°</u>	
7° to the left	of	105°	<u>105°</u>	<u>-</u>	<u>7° = 098°</u>	
13° to the right	of	010°	<u>010°</u>	<u>+</u>	<u>13° = 023°</u>	
18° to the left	of	002°	<u>362°</u>	<u>-</u>	<u>18° = 344°</u>	*****
3° to the right	of	357°	<u>357°</u>	<u>+</u>	<u>3° = 360°</u>	or <u>000°</u>
16° to the left	of	337°	<u>337°</u>	<u>-</u>	<u>16° = 321°</u>	
18° to the right	of	297°	<u>297°</u>	<u>+</u>	<u>18° = 315°</u>	
16° to the right	of	355°	<u>355°</u>	<u>+</u>	<u>16° = 371°</u>	or <u>011°</u>
6° to the right	of	036°	<u>036°</u>	<u>+</u>	<u>6° = 042°</u>	
21° to the left	of	011°	<u>371°</u>	<u>-</u>	<u>21° = 350°</u>	*****
8° to the left	of	009°	<u>009°</u>	<u>-</u>	<u>8° = 001°</u>	
17° to the left	of	289°	<u>289°</u>	<u>-</u>	<u>17° = 272°</u>	
20° to the left	of	167°	<u>167°</u>	<u>-</u>	<u>20° = 147°</u>	
12° to the right	of	355°	<u>355°</u>	<u>+</u>	<u>12° = 367°</u>	or <u>007°</u>
12° to the left	of	063°	<u>063°</u>	<u>-</u>	<u>12° = 051°</u>	
5° to the left	of	113°	<u>113°</u>	<u>-</u>	<u>5° = 108°</u>	
9° to the right	of	195°	<u>195°</u>	<u>+</u>	<u>9° = 204°</u>	
16° to the left	of	076°	<u>076°</u>	<u>-</u>	<u>16° = 060°</u>	
20° to the right	of	354°	<u>354°</u>	<u>+</u>	<u>20° = 374°</u>	or <u>014°</u>
3° to the right	of	248°	<u>248°</u>	<u>+</u>	<u>3° = 251°</u>	
5° to the right	of	277°	<u>277°</u>	<u>+</u>	<u>5° = 282°</u>	
12° to the left	of	002°	<u>362°</u>	<u>-</u>	<u>12° = 350°</u>	*****
11° to the left	of	038°	<u>038°</u>	<u>-</u>	<u>11° = 027°</u>	
9° to the left	of	104°	<u>104°</u>	<u>-</u>	<u>9° = 095°</u>	
8° to the right	of	353°	<u>353°</u>	<u>+</u>	<u>8° = 361°</u>	or <u>001°</u>
4° to the left	of	074°	<u>074°</u>	<u>-</u>	<u>4° = 070°</u>	
7° to the right	of	059°	<u>059°</u>	<u>+</u>	<u>7° = 066°</u>	
19° to the right	of	073°	<u>073°</u>	<u>+</u>	<u>19° = 092°</u>	
7° to the left	of	090°	<u>090°</u>	<u>-</u>	<u>7° = 083°</u>	
9° to the left	of	005°	<u>365°</u>	<u>-</u>	<u>9° = 356°</u>	
18° to the left	of	178°	<u>178°</u>	<u>-</u>	<u>18° = 160°</u>	
14° to the left	of	018°	<u>018°</u>	<u>-</u>	<u>14° = 004°</u>	
7° to the left	of	344°	<u>344°</u>	<u>-</u>	<u>7° = 337°</u>	
11° to the left	of	286°	<u>286°</u>	<u>-</u>	<u>11° = 275°</u>	
8° to the right	of	275°	<u>275°</u>	<u>+</u>	<u>8° = 283°</u>	

Solve for True Bearing

True Heading	Rel. Bearing	True Bearing	True Heading	Rel. Bearing	True Bearing
061°	+	185° = _____	194°	+	116° = _____
280°	+	190° = _____	186°	+	149° = _____
154°	+	348° = _____	195°	+	332° = _____
270°	+	186° = _____	257°	+	314° = _____
138°	+	118° = _____	178°	+	092° = _____
188°	+	277° = _____	240°	+	116° = _____
120°	+	279° = _____	196°	+	126° = _____
235°	+	024° = _____	326°	+	177° = _____
070°	+	203° = _____	088°	+	256° = _____
123°	+	294° = _____	059°	+	346° = _____
021°	+	058° = _____	052°	+	146° = _____
223°	+	313° = _____	295°	+	184° = _____
185°	+	330° = _____	301°	+	158° = _____
020°	+	077° = _____	271°	+	333° = _____
321°	+	203° = _____	039°	+	171° = _____
041°	+	348° = _____	062°	+	318° = _____
076°	+	268° = _____	040°	+	322° = _____
330°	+	332° = _____	286°	+	147° = _____
243°	+	057° = _____	332°	+	311° = _____
220°	+	197° = _____	038°	+	171° = _____
049°	+	257° = _____	267°	+	283° = _____
198°	+	275° = _____	070°	+	175° = _____
077°	+	035° = _____	248°	+	217° = _____
149°	+	124° = _____	146°	+	332° = _____
058°	+	259° = _____	088°	+	174° = _____
275°	+	068° = _____	315°	+	014° = _____

Solve for Relative Bearing

True Heading	True Bearing	Rel. Bearing	True Heading	True Bearing	Rel. Bearing
013°	+/-	065° = _____	270°	+/-	248° = _____
316°	+/-	154° = _____	172°	+/-	254° = _____
239°	+/-	179° = _____	238°	+/-	323° = _____
179°	+/-	128° = _____	302°	+/-	253° = _____
132°	+/-	014° = _____	322°	+/-	209° = _____
360°	+/-	021° = _____	355°	+/-	307° = _____
157°	+/-	103° = _____	175°	+/-	236° = _____
274°	+/-	085° = _____	124°	+/-	246° = _____
046°	+/-	246° = _____	040°	+/-	015° = _____
155°	+/-	002° = _____	188°	+/-	327° = _____
090°	+/-	060° = _____	165°	+/-	150° = _____
015°	+/-	354° = _____	115°	+/-	035° = _____
172°	+/-	103° = _____	253°	+/-	015° = _____
045°	+/-	124° = _____	260°	+/-	201° = _____
232°	+/-	011° = _____	294°	+/-	212° = _____
088°	+/-	296° = _____	185°	+/-	330° = _____
343°	+/-	358° = _____	155°	+/-	097° = _____
058°	+/-	006° = _____	266°	+/-	237° = _____
107°	+/-	050° = _____	314°	+/-	051° = _____
273°	+/-	160° = _____	164°	+/-	301° = _____
207°	+/-	166° = _____	058°	+/-	126° = _____
162°	+/-	094° = _____	339°	+/-	072° = _____
204°	+/-	205° = _____	117°	+/-	294° = _____
119°	+/-	134° = _____	069°	+/-	138° = _____
246°	+/-	095° = _____	208°	+/-	353° = _____

Solve for True Bearing

True Heading	Rel. Bearing	True Bearing	True Heading	Rel. Bearing	True Bearing
061°	+	185° =	194°	+	116° =
280°	+	190° =	186°	+	149° =
154°	+	348° =	195°	+	332° =
270°	+	186° =	257°	+	314° =
138°	+	118° =	178°	+	092° =
188°	+	277° =	240°	+	116° =
120°	+	279° =	196°	+	126° =
235°	+	024° =	326°	+	177° =
070°	+	203° =	088°	+	256° =
123°	+	294° =	059°	+	346° =
021°	+	058° =	052°	+	146° =
223°	+	313° =	295°	+	184° =
185°	+	330° =	301°	+	158° =
020°	+	077° =	271°	+	333° =
321°	+	203° =	039°	+	171° =
041°	+	348° =	062°	+	318° =
076°	+	268° =	040°	+	322° =
330°	+	332° =	286°	+	147° =
243°	+	057° =	332°	+	311° =
220°	+	197° =	038°	+	171° =
049°	+	257° =	267°	+	283° =
198°	+	275° =	070°	+	175° =
077°	+	035° =	248°	+	217° =
149°	+	124° =	146°	+	332° =
058°	+	259° =	088°	+	174° =
275°	+	068° =	315°	+	014° =

Solve for Relative Bearing

True Heading	True Bearing	Rel. Bearing	True Heading	True Bearing	Rel. Bearing
013°	+/-	065° =	270°	+/-	248° =
316°	+/-	154° =	172°	+/-	254° =
239°	+/-	179° =	238°	+/-	323° =
179°	+/-	128° =	302°	+/-	253° =
132°	+/-	014° =	322°	+/-	209° =
360°	+/-	021° =	355°	+/-	307° =
157°	+/-	103° =	175°	+/-	236° =
274°	+/-	085° =	124°	+/-	246° =
046°	+/-	246° =	040°	+/-	015° =
155°	+/-	002° =	188°	+/-	327° =
090°	+/-	060° =	165°	+/-	150° =
015°	+/-	354° =	115°	+/-	035° =
172°	+/-	103° =	253°	+/-	015° =
045°	+/-	124° =	260°	+/-	201° =
232°	+/-	011° =	294°	+/-	212° =
088°	+/-	296° =	185°	+/-	330° =
343°	+/-	358° =	155°	+/-	097° =
058°	+/-	006° =	266°	+/-	237° =
107°	+/-	050° =	314°	+/-	051° =
273°	+/-	160° =	164°	+/-	301° =
207°	+/-	166° =	058°	+/-	126° =
162°	+/-	094° =	339°	+/-	072° =
204°	+/-	205° =	117°	+/-	294° =
119°	+/-	134° =	069°	+/-	138° =
246°	+/-	095° =	208°	+/-	353° =

Navigation Math Skills

Reciprocal Direction

1	the reciprocal direction of	030°	<input type="text"/>	180° =	_____	the reciprocal direction of	210°	<input type="text"/>	180° =	_____
2	the reciprocal direction of	160°	<input type="text"/>	180° =	_____	the reciprocal direction of	070°	<input type="text"/>	180° =	_____
3	the reciprocal direction of	230°	<input type="text"/>	180° =	_____	the reciprocal direction of	290°	<input type="text"/>	180° =	_____
4	the reciprocal direction of	310°	<input type="text"/>	180° =	_____	the reciprocal direction of	150°	<input type="text"/>	180° =	_____
5	the reciprocal direction of	100°	<input type="text"/>	180° =	_____	the reciprocal direction of	340°	<input type="text"/>	180° =	_____
6	the reciprocal direction of	240°	<input type="text"/>	180° =	_____	the reciprocal direction of	180°	<input type="text"/>	180° =	_____
7	the reciprocal direction of	170°	<input type="text"/>	180° =	_____	the reciprocal direction of	310°	<input type="text"/>	180° =	_____
8	the reciprocal direction of	030°	<input type="text"/>	180° =	_____	the reciprocal direction of	270°	<input type="text"/>	180° =	_____
9	the reciprocal direction of	020°	<input type="text"/>	180° =	_____	the reciprocal direction of	120°	<input type="text"/>	180° =	_____
10	the reciprocal direction of	340°	<input type="text"/>	180° =	_____	the reciprocal direction of	190°	<input type="text"/>	180° =	_____
11	the reciprocal direction of	100°	<input type="text"/>	180° =	_____	the reciprocal direction of	090°	<input type="text"/>	180° =	_____
12	the reciprocal direction of	060°	<input type="text"/>	180° =	_____	the reciprocal direction of	190°	<input type="text"/>	180° =	_____
13	the reciprocal direction of	260°	<input type="text"/>	180° =	_____	the reciprocal direction of	010°	<input type="text"/>	180° =	_____
14	the reciprocal direction of	240°	<input type="text"/>	180° =	_____	the reciprocal direction of	070°	<input type="text"/>	180° =	_____
15	the reciprocal direction of	280°	<input type="text"/>	180° =	_____	the reciprocal direction of	110°	<input type="text"/>	180° =	_____
17	the reciprocal direction of	N	<input type="text"/> +/-	180° =	S	the reciprocal direction of	ESE	<input type="text"/> +/-	180° =	_____
18	the reciprocal direction of	S	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	SE	<input type="text"/> +/-	180° =	_____
19	the reciprocal direction of	NNE	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	NNW	<input type="text"/> +/-	180° =	_____
20	the reciprocal direction of	E	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	E	<input type="text"/> +/-	180° =	_____
21	the reciprocal direction of	ESE	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	ENE	<input type="text"/> +/-	180° =	_____
22	the reciprocal direction of	S	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	ESE	<input type="text"/> +/-	180° =	_____
23	the reciprocal direction of	SW	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	WSW	<input type="text"/> +/-	180° =	_____
24	the reciprocal direction of	SSE	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	W	<input type="text"/> +/-	180° =	_____
25	the reciprocal direction of	NE	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	NNW	<input type="text"/> +/-	180° =	_____
26	the reciprocal direction of	N	<input type="text"/> +/-	180° =	_____	the reciprocal direction of	NNE	<input type="text"/> +/-	180° =	_____
28	the reciprocal direction of	251°	<input type="text"/>	180° =	_____	the reciprocal direction of	161°	<input type="text"/>	180° =	_____
29	the reciprocal direction of	231°	<input type="text"/>	180° =	_____	the reciprocal direction of	182°	<input type="text"/>	180° =	_____
30	the reciprocal direction of	272°	<input type="text"/>	180° =	_____	the reciprocal direction of	286°	<input type="text"/>	180° =	_____
31	the reciprocal direction of	214°	<input type="text"/>	180° =	_____	the reciprocal direction of	149°	<input type="text"/>	180° =	_____
32	the reciprocal direction of	225°	<input type="text"/>	180° =	_____	the reciprocal direction of	193°	<input type="text"/>	180° =	_____
33	the reciprocal direction of	283°	<input type="text"/>	180° =	_____	the reciprocal direction of	327°	<input type="text"/>	180° =	_____
34	the reciprocal direction of	352°	<input type="text"/>	180° =	_____	the reciprocal direction of	267°	<input type="text"/>	180° =	_____
35	the reciprocal direction of	229°	<input type="text"/>	180° =	_____	the reciprocal direction of	224°	<input type="text"/>	180° =	_____
36	the reciprocal direction of	338°	<input type="text"/>	180° =	_____	the reciprocal direction of	249°	<input type="text"/>	180° =	_____
37	the reciprocal direction of	127°	<input type="text"/>	180° =	_____	the reciprocal direction of	160°	<input type="text"/>	180° =	_____
38	the reciprocal direction of	248°	<input type="text"/>	180° =	_____	the reciprocal direction of	113°	<input type="text"/>	180° =	_____
39	the reciprocal direction of	108°	<input type="text"/>	180° =	_____	the reciprocal direction of	172°	<input type="text"/>	180° =	_____
40	the reciprocal direction of	114°	<input type="text"/>	180° =	_____	the reciprocal direction of	243°	<input type="text"/>	180° =	_____
41	the reciprocal direction of	218°	<input type="text"/>	180° =	_____	the reciprocal direction of	304°	<input type="text"/>	180° =	_____
42	the reciprocal direction of	035°	<input type="text"/>	180° =	_____	the reciprocal direction of	119°	<input type="text"/>	180° =	_____

Navigation Math Skills

Reciprocal Direction Answers

1 the reciprocal direction of	030°	<input type="checkbox"/>	180° =	<u>210°</u>	the reciprocal direction of	210°	<input type="checkbox"/>	180° =	<u>030°</u>
2 the reciprocal direction of	160°	<input type="checkbox"/>	180° =	<u>340°</u>	the reciprocal direction of	070°	<input type="checkbox"/>	180° =	<u>250°</u>
3 the reciprocal direction of	230°	<input type="checkbox"/>	180° =	<u>050°</u>	the reciprocal direction of	290°	<input type="checkbox"/>	180° =	<u>110°</u>
4 the reciprocal direction of	310°	<input type="checkbox"/>	180° =	<u>130°</u>	the reciprocal direction of	150°	<input type="checkbox"/>	180° =	<u>330°</u>
5 the reciprocal direction of	100°	<input type="checkbox"/>	180° =	<u>280°</u>	the reciprocal direction of	340°	<input type="checkbox"/>	180° =	<u>160°</u>
6 the reciprocal direction of	240°	<input type="checkbox"/>	180° =	<u>060°</u>	the reciprocal direction of	180°	<input type="checkbox"/>	180° =	<u>000°</u>
7 the reciprocal direction of	170°	<input type="checkbox"/>	180° =	<u>350°</u>	the reciprocal direction of	310°	<input type="checkbox"/>	180° =	<u>130°</u>
8 the reciprocal direction of	030°	<input type="checkbox"/>	180° =	<u>210°</u>	the reciprocal direction of	270°	<input type="checkbox"/>	180° =	<u>090°</u>
9 the reciprocal direction of	020°	<input type="checkbox"/>	180° =	<u>200°</u>	the reciprocal direction of	120°	<input type="checkbox"/>	180° =	<u>300°</u>
10 the reciprocal direction of	340°	<input type="checkbox"/>	180° =	<u>160°</u>	the reciprocal direction of	190°	<input type="checkbox"/>	180° =	<u>010°</u>
11 the reciprocal direction of	100°	<input type="checkbox"/>	180° =	<u>280°</u>	the reciprocal direction of	090°	<input type="checkbox"/>	180° =	<u>270°</u>
12 the reciprocal direction of	060°	<input type="checkbox"/>	180° =	<u>240°</u>	the reciprocal direction of	190°	<input type="checkbox"/>	180° =	<u>010°</u>
13 the reciprocal direction of	260°	<input type="checkbox"/>	180° =	<u>080°</u>	the reciprocal direction of	010°	<input type="checkbox"/>	180° =	<u>190°</u>
14 the reciprocal direction of	240°	<input type="checkbox"/>	180° =	<u>060°</u>	the reciprocal direction of	070°	<input type="checkbox"/>	180° =	<u>250°</u>
15 the reciprocal direction of	280°	<input type="checkbox"/>	180° =	<u>100°</u>	the reciprocal direction of	110°	<input type="checkbox"/>	180° =	<u>290°</u>
17 the reciprocal direction of	N	<input type="checkbox"/>	180° =	<u>S</u>	the reciprocal direction of	ESE	<input type="checkbox"/>	180° =	<u>WNW</u>
18 the reciprocal direction of	S	<input type="checkbox"/>	180° =	<u>N</u>	the reciprocal direction of	SE	<input type="checkbox"/>	180° =	<u>NW</u>
19 the reciprocal direction of	NNE	<input type="checkbox"/>	180° =	<u>SSW</u>	the reciprocal direction of	NNW	<input type="checkbox"/>	180° =	<u>SSE</u>
20 the reciprocal direction of	E	<input type="checkbox"/>	180° =	<u>W</u>	the reciprocal direction of	E	<input type="checkbox"/>	180° =	<u>W</u>
21 the reciprocal direction of	ESE	<input type="checkbox"/>	180° =	<u>WNW</u>	the reciprocal direction of	ENE	<input type="checkbox"/>	180° =	<u>WSW</u>
22 the reciprocal direction of	S	<input type="checkbox"/>	180° =	<u>N</u>	the reciprocal direction of	ESE	<input type="checkbox"/>	180° =	<u>WNW</u>
23 the reciprocal direction of	SW	<input type="checkbox"/>	180° =	<u>NE</u>	the reciprocal direction of	WSW	<input type="checkbox"/>	180° =	<u>ENE</u>
24 the reciprocal direction of	SSE	<input type="checkbox"/>	180° =	<u>NNW</u>	the reciprocal direction of	W	<input type="checkbox"/>	180° =	<u>E</u>
25 the reciprocal direction of	NE	<input type="checkbox"/>	180° =	<u>SW</u>	the reciprocal direction of	NNW	<input type="checkbox"/>	180° =	<u>SSE</u>
26 the reciprocal direction of	N	<input type="checkbox"/>	180° =	<u>S</u>	the reciprocal direction of	NNE	<input type="checkbox"/>	180° =	<u>SSW</u>
28 the reciprocal direction of	251°	<input type="checkbox"/>	180° =	<u>071°</u>	the reciprocal direction of	161°	<input type="checkbox"/>	180° =	<u>341°</u>
29 the reciprocal direction of	231°	<input type="checkbox"/>	180° =	<u>051°</u>	the reciprocal direction of	182°	<input type="checkbox"/>	180° =	<u>002°</u>
30 the reciprocal direction of	272°	<input type="checkbox"/>	180° =	<u>092°</u>	the reciprocal direction of	286°	<input type="checkbox"/>	180° =	<u>106°</u>
31 the reciprocal direction of	214°	<input type="checkbox"/>	180° =	<u>034°</u>	the reciprocal direction of	149°	<input type="checkbox"/>	180° =	<u>329°</u>
32 the reciprocal direction of	225°	<input type="checkbox"/>	180° =	<u>045°</u>	the reciprocal direction of	193°	<input type="checkbox"/>	180° =	<u>013°</u>
33 the reciprocal direction of	283°	<input type="checkbox"/>	180° =	<u>103°</u>	the reciprocal direction of	327°	<input type="checkbox"/>	180° =	<u>147°</u>
34 the reciprocal direction of	352°	<input type="checkbox"/>	180° =	<u>172°</u>	the reciprocal direction of	267°	<input type="checkbox"/>	180° =	<u>087°</u>
35 the reciprocal direction of	229°	<input type="checkbox"/>	180° =	<u>049°</u>	the reciprocal direction of	224°	<input type="checkbox"/>	180° =	<u>044°</u>
36 the reciprocal direction of	338°	<input type="checkbox"/>	180° =	<u>158°</u>	the reciprocal direction of	249°	<input type="checkbox"/>	180° =	<u>069°</u>
37 the reciprocal direction of	127°	<input type="checkbox"/>	180° =	<u>307°</u>	the reciprocal direction of	160°	<input type="checkbox"/>	180° =	<u>340°</u>
38 the reciprocal direction of	248°	<input type="checkbox"/>	180° =	<u>068°</u>	the reciprocal direction of	113°	<input type="checkbox"/>	180° =	<u>293°</u>
39 the reciprocal direction of	108°	<input type="checkbox"/>	180° =	<u>288°</u>	the reciprocal direction of	172°	<input type="checkbox"/>	180° =	<u>352°</u>
40 the reciprocal direction of	114°	<input type="checkbox"/>	180° =	<u>294°</u>	the reciprocal direction of	243°	<input type="checkbox"/>	180° =	<u>063°</u>
41 the reciprocal direction of	218°	<input type="checkbox"/>	180° =	<u>038°</u>	the reciprocal direction of	304°	<input type="checkbox"/>	180° =	<u>124°</u>
42 the reciprocal direction of	035°	<input type="checkbox"/>	180° =	<u>215°</u>	the reciprocal direction of	119°	<input type="checkbox"/>	180° =	<u>299°</u>

000.0°	N
022.5°	NNE
045.0°	NE
067.5°	ENE
090.0°	E
112.5°	ESE
135.0°	SE
157.5°	SSE
180.0°	S
202.5°	SSW
225.0°	SW
247.5°	WSW
270.0°	W
292.5°	WNW
315.0°	NW
337.5°	NNW
360.0°	N

000.0°	_____
157.5°	_____
337.5°	_____
022.5°	_____
225.0°	_____
292.5°	_____
292.5°	_____
180.0°	_____
022.5°	_____
180.0°	_____
337.5°	_____
270.0°	_____
045.0°	_____
315.0°	_____
202.5°	_____

ENE	_____
WNW	_____
SE	_____
NNW	_____
SSW	_____
E	_____
WSW	_____
WNW	_____
WNW	_____
S	_____
SW	_____
NNW	_____
S	_____
WNW	_____
WSW	_____

SW	_____
NNW	_____
E	_____
E	_____
W	_____
NW	_____
SW	_____
ENE	_____
WSW	_____
S	_____
NE	_____
NNE	_____
ESE	_____
N	_____
NNW	_____

090.0°	_____
315.0°	_____
135.0°	_____
292.5°	_____
045.0°	_____

180.0°	_____
202.5°	_____
090.0°	_____
090.0°	_____
000.0°	_____

SE	_____
E	_____
NNE	_____
N	_____
WNW	_____

E	_____
NNE	_____
N	_____
NNE	_____
WSW	_____

157.5°	_____
247.5°	_____
270.0°	_____
000.0°	_____
337.5°	_____

045.0°	_____
315.0°	_____
090.0°	_____
112.5°	_____
360.0°	_____

E	_____
SW	_____
WNW	_____
SE	_____
SSW	_____

SSE	_____
WSW	_____
ENE	_____
ENE	_____
NE	_____

225.0°	_____
225.0°	_____
135.0°	_____
360.0°	_____
202.5°	_____

022.5°	_____
180.0°	_____
157.5°	_____
112.5°	_____
157.5°	_____

SSW	_____
SSW	_____
ESE	_____
SW	_____
SE	_____

NNW	_____
SW	_____
NE	_____
SSE	_____
SE	_____

135.0°	_____
180.0°	_____
067.5°	_____
135.0°	_____
022.5°	_____

292.5°	_____
045.0°	_____
180.0°	_____
225.0°	_____
135.0°	_____

E	_____
E	_____
E	_____
SSE	_____
NNE	_____

WNW	_____
SE	_____
SW	_____
SSW	_____
S	_____

157.5°	_____
157.5°	_____
270.0°	_____
067.5°	_____
225.0°	_____

202.5°	_____
045.0°	_____
337.5°	_____
337.5°	_____
090.0°	_____

SE	_____
ESE	_____
N	_____
S	_____
S	_____

NW	_____
SSW	_____
NE	_____
S	_____
NNW	_____

112.5°	_____
--------	-------

337.5°	_____
--------	-------

N	_____
---	-------

WSW	_____
-----	-------

Navigation Math Skills

Boxing Answers

000.0°	N
022.5°	NNE
045.0°	NE
067.5°	ENE
090.0°	E
112.5°	ESE
135.0°	SE
157.5°	SSE
180.0°	S
202.5°	SSW
225.0°	SW
247.5°	WSW
270.0°	W
292.5°	WNW
315.0°	NW
337.5°	NNW
360.0°	N

000.0°	N
157.5°	SSE
337.5°	NNW
022.5°	NNE
225.0°	SW
292.5°	WNW
292.5°	WNW
180.0°	S
022.5°	NNE
180.0°	S
337.5°	NNW
270.0°	W
045.0°	NE
315.0°	NW
202.5°	SSW

ENE	067.5°
WNW	292.5°
SE	135.0°
NNW	337.5°
SSW	202.5°
E	090.0°
WSW	247.5°
WNW	292.5°
WNW	292.5°
S	180.0°
SW	225.0°
NNW	337.5°
S	180.0°
WNW	292.5°
WSW	247.5°

SW	225.0°
NNW	337.5°
E	090.0°
E	090.0°
W	270.0°
NW	315.0°
SW	225.0°
ENE	067.5°
WSW	247.5°
S	180.0°
NE	045.0°
NNE	022.5°
ESE	112.5°
N	000.0°
NNW	337.5°

090.0°	E
315.0°	NW
135.0°	SE
292.5°	WNW
045.0°	NE

180.0°	S
202.5°	SSW
090.0°	E
090.0°	E
000.0°	N

SE	135.0°
E	090.0°
NNE	022.5°
N	360.0°
WNW	292.5°

E	090.0°
NNE	022.5°
N	000.0°
NNE	022.5°
WSW	247.5°

157.5°	SSE
247.5°	WSW
270.0°	W
000.0°	N
337.5°	NNW

045.0°	NE
315.0°	NW
090.0°	E
112.5°	ESE
360.0°	N

E	090.0°
SW	225.0°
WNW	292.5°
SE	135.0°
SSW	202.5°

SSE	157.5°
WSW	247.5°
ENE	067.5°
ENE	067.5°
NE	045.0°

225.0°	SW
225.0°	SW
135.0°	SE
360.0°	N
202.5°	SSW

022.5°	NNE
180.0°	S
157.5°	SSE
112.5°	ESE
157.5°	SSE

SSW	202.5°
SSW	202.5°
ESE	112.5°
SW	225.0°
SE	135.0°

NNW	337.5°
SW	225.0°
NE	045.0°
SSE	157.5°
SE	135.0°

135.0°	SE
180.0°	S
067.5°	ENE
135.0°	SE
022.5°	NNE

292.5°	WNW
045.0°	NE
180.0°	S
225.0°	SW
135.0°	SE

E	090.0°
E	090.0°
E	090.0°
SSE	157.5°
NNE	022.5°

WNW	292.5°
SE	135.0°
SW	225.0°
SSW	202.5°
S	180.0°

157.5°	SSE
157.5°	SSE
270.0°	W
067.5°	ENE
225.0°	SW

202.5°	SSW
045.0°	NE
337.5°	NNW
337.5°	NNW
090.0°	E

SE	135.0°
ESE	112.5°
N	360.0°
S	180.0°
S	180.0°

NW	315.0°
SSW	202.5°
NE	045.0°
S	180.0°
NNW	337.5°

112.5°	ESE
--------	-----

337.5°	NNW
--------	-----

N	000.0°
---	--------

WSW	247.5°
-----	--------



Find the time difference between two consecutive tides. Use addition of time instead of subtraction.

HW 08 07 \_\_\_\_\_ min. to the top of the next hour  
 LW 15 43 \_\_\_\_\_ from 09 00 to 15 43  
 Time Diff. \_\_\_\_\_

HW 14 28 \_\_\_\_\_ min. to the top of the next hour  
 LW 21 01 \_\_\_\_\_ from 15 00 to 21 01  
 Time Diff. \_\_\_\_\_

HW 05 22 \_\_\_\_\_ min. to the top of the next hour  
 LW 10 42 \_\_\_\_\_ from 06 00 to 10 42  
 Time Diff. \_\_\_\_\_

HW 06 41 \_\_\_\_\_ min. to the top of the next hour  
 LW 14 22 \_\_\_\_\_ from 07 00 to 14 22  
 Time Diff. \_\_\_\_\_

LW 19 16 \_\_\_\_\_ min. to the top of the next hour  
 HW 01 22 \_\_\_\_\_ from 20 00 to 01 22  
 Time Diff. \_\_\_\_\_

HW 09 08 \_\_\_\_\_ min. to the top of the next hour  
 LW 16 38 \_\_\_\_\_ from 10 00 to 16 38  
 Time Diff. \_\_\_\_\_

LW 11 53 \_\_\_\_\_ min. to the top of the next hour  
 HW 18 01 \_\_\_\_\_ from 12 00 to 18 01  
 Time Diff. \_\_\_\_\_

HW 17 24 \_\_\_\_\_ min. to the top of the next hour  
 LW 00 03 \_\_\_\_\_ from 18 00 to 00 03  
 Time Diff. \_\_\_\_\_

LW 14 05 \_\_\_\_\_ min. to the top of the next hour  
 HW 21 57 \_\_\_\_\_ from 15 00 to 21 57  
 Time Diff. \_\_\_\_\_

LW 11 31 \_\_\_\_\_ min. to the top of the next hour  
 HW 17 28 \_\_\_\_\_ from 12 00 to 17 28  
 Time Diff. \_\_\_\_\_

LW 03 29 \_\_\_\_\_ min. to the top of the next hour  
 HW 09 23 \_\_\_\_\_ from 04 00 to 09 23  
 Time Diff. \_\_\_\_\_

LW 02 50 \_\_\_\_\_ min. to the top of the next hour  
 HW 09 35 \_\_\_\_\_ from 03 00 to 09 35  
 Time Diff. \_\_\_\_\_

HW 09 04 \_\_\_\_\_ min. to the top of the next hour  
 LW 15 44 \_\_\_\_\_ from 10 00 to 15 44  
 Time Diff. \_\_\_\_\_

LW 05 37 \_\_\_\_\_ min. to the top of the next hour  
 HW 10 59 \_\_\_\_\_ from 06 00 to 10 59  
 Time Diff. \_\_\_\_\_

LW 12 59 \_\_\_\_\_ min. to the top of the next hour  
 HW 20 13 \_\_\_\_\_ from 13 00 to 20 13  
 Time Diff. \_\_\_\_\_

LW 22 16 \_\_\_\_\_ min. to the top of the next hour  
 HW 04 19 \_\_\_\_\_ from 23 00 to 04 19  
 Time Diff. \_\_\_\_\_

LW 02 55 \_\_\_\_\_ min. to the top of the next hour  
 HW 10 46 \_\_\_\_\_ from 03 00 to 10 46  
 Time Diff. \_\_\_\_\_

HW 20 08 \_\_\_\_\_ min. to the top of the next hour  
 LW 02 14 \_\_\_\_\_ from 21 00 to 02 14  
 Time Diff. \_\_\_\_\_

LW 21 15 \_\_\_\_\_ min. to the top of the next hour  
 HW 03 35 \_\_\_\_\_ from 22 00 to 03 35  
 Time Diff. \_\_\_\_\_

LW 21 02 \_\_\_\_\_ min. to the top of the next hour  
 HW 03 01 \_\_\_\_\_ from 22 00 to 03 01  
 Time Diff. \_\_\_\_\_

HW 20 25 \_\_\_\_\_ min. to the top of the next hour  
 LW 03 17 \_\_\_\_\_ from 21 00 to 03 17  
 Time Diff. \_\_\_\_\_

HW 12 05 \_\_\_\_\_ min. to the top of the next hour  
 LW 18 16 \_\_\_\_\_ from 13 00 to 18 16  
 Time Diff. \_\_\_\_\_

LW 01 16 \_\_\_\_\_ min. to the top of the next hour  
 HW 06 32 \_\_\_\_\_ from 02 00 to 06 32  
 Time Diff. \_\_\_\_\_

LW 15 29 \_\_\_\_\_ min. to the top of the next hour  
 HW 22 39 \_\_\_\_\_ from 16 00 to 22 39  
 Time Diff. \_\_\_\_\_

HW 21 07 \_\_\_\_\_ min. to the top of the next hour  
 LW 03 21 \_\_\_\_\_ from 22 00 to 03 21  
 Time Diff. \_\_\_\_\_

HW 00 45 \_\_\_\_\_ min. to the top of the next hour  
 LW 07 55 \_\_\_\_\_ from 01 00 to 07 55  
 Time Diff. \_\_\_\_\_

LW 06 15 \_\_\_\_\_ min. to the top of the next hour  
 HW 12 18 \_\_\_\_\_ from 07 00 to 12 18  
 Time Diff. \_\_\_\_\_

LW 04 07 \_\_\_\_\_ min. to the top of the next hour  
 HW 10 09 \_\_\_\_\_ from 05 00 to 10 09  
 Time Diff. \_\_\_\_\_

Find the time difference between two consecutive tides. Use addition of time instead of subtraction.

$$\begin{array}{r} \text{HW } 08\ 07 \\ \text{LW } 15\ 43 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 53 \text{ min. to the top of the next hour} \\ 06\ 43 \text{ from } 09\ 00 \text{ to } 15\ 43 \\ \hline 07\ 36 \end{array}$$

$$\begin{array}{r} \text{LW } 12\ 59 \\ \text{HW } 20\ 13 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 01 \text{ min. to the top of the next hour} \\ 07\ 13 \text{ from } 13\ 00 \text{ to } 20\ 13 \\ \hline 07\ 14 \end{array}$$

$$\begin{array}{r} \text{HW } 14\ 28 \\ \text{LW } 21\ 01 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 32 \text{ min. to the top of the next hour} \\ 06\ 01 \text{ from } 15\ 00 \text{ to } 21\ 01 \\ \hline 06\ 33 \end{array}$$

$$\begin{array}{r} \text{LW } 22\ 16 \\ \text{HW } 04\ 19 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 44 \text{ min. to the top of the next hour} \\ 05\ 19 \text{ from } 23\ 00 \text{ to } 04\ 19 \\ \hline 06\ 03 \end{array}$$

$$\begin{array}{r} \text{HW } 05\ 22 \\ \text{LW } 10\ 42 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 38 \text{ min. to the top of the next hour} \\ 04\ 42 \text{ from } 06\ 00 \text{ to } 10\ 42 \\ \hline 05\ 20 \end{array}$$

$$\begin{array}{r} \text{LW } 02\ 55 \\ \text{HW } 10\ 46 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 05 \text{ min. to the top of the next hour} \\ 07\ 46 \text{ from } 03\ 00 \text{ to } 10\ 46 \\ \hline 07\ 51 \end{array}$$

$$\begin{array}{r} \text{HW } 06\ 41 \\ \text{LW } 14\ 22 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 19 \text{ min. to the top of the next hour} \\ 07\ 22 \text{ from } 07\ 00 \text{ to } 14\ 22 \\ \hline 07\ 41 \end{array}$$

$$\begin{array}{r} \text{HW } 20\ 08 \\ \text{LW } 02\ 14 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 52 \text{ min. to the top of the next hour} \\ 05\ 14 \text{ from } 21\ 00 \text{ to } 02\ 14 \\ \hline 06\ 06 \end{array}$$

$$\begin{array}{r} \text{LW } 19\ 16 \\ \text{HW } 01\ 22 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 44 \text{ min. to the top of the next hour} \\ 05\ 22 \text{ from } 20\ 00 \text{ to } 01\ 22 \\ \hline 06\ 06 \end{array}$$

$$\begin{array}{r} \text{LW } 21\ 15 \\ \text{HW } 03\ 35 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 45 \text{ min. to the top of the next hour} \\ 05\ 35 \text{ from } 22\ 00 \text{ to } 03\ 35 \\ \hline 06\ 20 \end{array}$$

$$\begin{array}{r} \text{HW } 09\ 08 \\ \text{LW } 16\ 38 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 52 \text{ min. to the top of the next hour} \\ 06\ 38 \text{ from } 10\ 00 \text{ to } 16\ 38 \\ \hline 07\ 30 \end{array}$$

$$\begin{array}{r} \text{LW } 21\ 02 \\ \text{HW } 03\ 01 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 58 \text{ min. to the top of the next hour} \\ 05\ 01 \text{ from } 22\ 00 \text{ to } 03\ 01 \\ \hline 05\ 59 \end{array}$$

$$\begin{array}{r} \text{LW } 11\ 53 \\ \text{HW } 18\ 01 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 07 \text{ min. to the top of the next hour} \\ 06\ 01 \text{ from } 12\ 00 \text{ to } 18\ 01 \\ \hline 06\ 08 \end{array}$$

$$\begin{array}{r} \text{HW } 20\ 25 \\ \text{LW } 03\ 17 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 35 \text{ min. to the top of the next hour} \\ 06\ 17 \text{ from } 21\ 00 \text{ to } 03\ 17 \\ \hline 06\ 52 \end{array}$$

$$\begin{array}{r} \text{HW } 17\ 24 \\ \text{LW } 00\ 03 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 36 \text{ min. to the top of the next hour} \\ 06\ 03 \text{ from } 18\ 00 \text{ to } 00\ 03 \\ \hline 06\ 39 \end{array}$$

$$\begin{array}{r} \text{HW } 12\ 05 \\ \text{LW } 18\ 16 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 55 \text{ min. to the top of the next hour} \\ 05\ 16 \text{ from } 13\ 00 \text{ to } 18\ 16 \\ \hline 06\ 11 \end{array}$$

$$\begin{array}{r} \text{LW } 14\ 05 \\ \text{HW } 21\ 57 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 55 \text{ min. to the top of the next hour} \\ 06\ 57 \text{ from } 15\ 00 \text{ to } 21\ 57 \\ \hline 07\ 52 \end{array}$$

$$\begin{array}{r} \text{LW } 01\ 16 \\ \text{HW } 06\ 32 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 44 \text{ min. to the top of the next hour} \\ 04\ 32 \text{ from } 02\ 00 \text{ to } 06\ 32 \\ \hline 05\ 16 \end{array}$$

$$\begin{array}{r} \text{LW } 11\ 31 \\ \text{HW } 17\ 28 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 29 \text{ min. to the top of the next hour} \\ 05\ 28 \text{ from } 12\ 00 \text{ to } 17\ 28 \\ \hline 05\ 57 \end{array}$$

$$\begin{array}{r} \text{LW } 15\ 29 \\ \text{HW } 22\ 39 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 31 \text{ min. to the top of the next hour} \\ 06\ 39 \text{ from } 16\ 00 \text{ to } 22\ 39 \\ \hline 07\ 10 \end{array}$$

$$\begin{array}{r} \text{LW } 03\ 29 \\ \text{HW } 09\ 23 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 31 \text{ min. to the top of the next hour} \\ 05\ 23 \text{ from } 04\ 00 \text{ to } 09\ 23 \\ \hline 05\ 54 \end{array}$$

$$\begin{array}{r} \text{HW } 21\ 07 \\ \text{LW } 03\ 21 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 53 \text{ min. to the top of the next hour} \\ 05\ 21 \text{ from } 22\ 00 \text{ to } 03\ 21 \\ \hline 06\ 14 \end{array}$$

$$\begin{array}{r} \text{LW } 02\ 50 \\ \text{HW } 09\ 35 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 10 \text{ min. to the top of the next hour} \\ 06\ 35 \text{ from } 03\ 00 \text{ to } 09\ 35 \\ \hline 06\ 45 \end{array}$$

$$\begin{array}{r} \text{HW } 00\ 45 \\ \text{LW } 07\ 55 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 15 \text{ min. to the top of the next hour} \\ 06\ 55 \text{ from } 01\ 00 \text{ to } 07\ 55 \\ \hline 07\ 10 \end{array}$$

$$\begin{array}{r} \text{HW } 09\ 04 \\ \text{LW } 15\ 44 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 56 \text{ min. to the top of the next hour} \\ 05\ 44 \text{ from } 10\ 00 \text{ to } 15\ 44 \\ \hline 06\ 40 \end{array}$$

$$\begin{array}{r} \text{LW } 06\ 15 \\ \text{HW } 12\ 18 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 45 \text{ min. to the top of the next hour} \\ 05\ 18 \text{ from } 07\ 00 \text{ to } 12\ 18 \\ \hline 06\ 03 \end{array}$$

$$\begin{array}{r} \text{LW } 05\ 37 \\ \text{HW } 10\ 59 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 23 \text{ min. to the top of the next hour} \\ 04\ 59 \text{ from } 06\ 00 \text{ to } 10\ 59 \\ \hline 05\ 22 \end{array}$$

$$\begin{array}{r} \text{LW } 04\ 07 \\ \text{HW } 10\ 09 \\ \hline \text{Time Diff. } \end{array} \quad \begin{array}{l} 0\ 53 \text{ min. to the top of the next hour} \\ 05\ 09 \text{ from } 05\ 00 \text{ to } 10\ 09 \\ \hline 06\ 02 \end{array}$$

Find the Time and Height differences & interpolate using the table below.

Ht. of Tide at 18 11

16 48 -1.0  
22 47 10.2

\_\_\_\_\_  
\_\_\_\_\_  
Time Diff.

\_\_\_\_\_  
\_\_\_\_\_  
Time Diff.

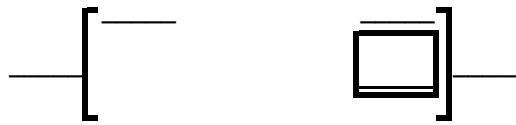


Ht. of Tide at 09 33

07 54 11.6  
13 21 -0.3

\_\_\_\_\_  
\_\_\_\_\_  
Time Diff.

\_\_\_\_\_  
\_\_\_\_\_  
Time Diff.



Ht. of Tide at 16 17

12 48 11.2  
17 52 -0.7

\_\_\_\_\_  
\_\_\_\_\_  
Time Diff.

\_\_\_\_\_  
\_\_\_\_\_  
Time Diff.



Ht. of Tide at 18 54

16 43 10.6  
23 00 0.0

\_\_\_\_\_  
\_\_\_\_\_  
Time Diff.

\_\_\_\_\_  
\_\_\_\_\_  
Time Diff.



5 00	0 10	0 20	0 30	0 40	0 50	1 00	1 10	1 20	1 30	1 40	1 50	2 00	2 10	2 20	2 30
5 20	0 11	0 21	0 32	0 43	0 53	1 04	1 15	1 25	1 35	1 47	1 57	2 08	2 19	2 29	2 40
5 40	0 11	0 23	0 34	0 45	0 57	1 08	1 19	1 31	1 42	1 53	2 05	2 15	2 27	2 39	2 50
6 00	0 12	0 24	0 36	0 48	1 00	1 12	1 24	1 36	1 48	2 00	2 12	2 24	2 36	2 48	3 00
6 20	0 13	0 25	0 38	0 51	1 03	1 16	1 29	1 41	1 54	2 07	2 19	2 32	2 45	2 57	3 10
6 40	0 13	0 27	0 40	0 53	1 07	1 20	1 33	1 47	2 00	2 13	2 27	2 40	2 53	3 07	3 20
7 00	0 14	0 28	0 42	0 56	1 10	1 24	1 38	1 52	2 06	2 20	2 34	2 48	3 02	3 16	3 30
5.5	0.0	0.1	0.1	0.2	0.4	0.5	0.7	0.9	1.1	1.4	1.6	1.9	2.2	2.5	2.8
6.0	0.0	0.1	0.1	0.3	0.4	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.7	3.0
6.5	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.1	1.3	1.6	1.9	2.2	2.6	2.9	3.2
7.0	0.0	0.1	0.2	0.3	0.5	0.7	0.9	1.2	1.4	1.8	2.1	2.4	2.8	3.1	3.5
7.5	0.0	0.1	0.2	0.3	0.5	0.7	1.0	1.2	1.5	1.9	2.2	2.6	3.0	3.4	3.8
8.0	0.0	0.1	0.2	0.3	0.5	0.8	1.0	1.3	1.6	2.0	2.4	2.8	3.2	3.6	4.0
8.5	0.0	0.1	0.2	0.4	0.6	0.8	1.1	1.4	1.8	2.1	2.5	2.9	3.4	3.8	4.2
9.0	0.0	0.1	0.2	0.4	0.6	0.9	1.2	1.5	1.9	2.2	2.7	3.1	3.6	4.0	4.5
9.5	0.0	0.1	0.2	0.4	0.6	0.9	1.2	1.6	2.0	2.4	2.8	3.3	3.8	4.3	4.8
10.0	0.0	0.1	0.2	0.4	0.7	1.0	1.3	1.8	2.1	2.5	3.0	3.5	4.0	4.5	5.0
10.5	0.0	0.1	0.3	0.5	0.7	1.0	1.3	1.7	2.2	2.6	3.1	3.6	4.2	4.7	5.2
11.0	0.0	0.1	0.3	0.5	0.7	1.1	1.4	1.8	2.3	2.8	3.3	3.8	4.4	4.9	5.5
11.5	0.0	0.1	0.3	0.5	0.8	1.1	1.5	1.9	2.4	2.9	3.4	4.0	4.6	5.1	5.8
12.0	0.0	0.1	0.3	0.5	0.8	1.1	1.6	2.0	2.5	3.0	3.6	4.1	4.8	5.4	6.0
12.5	0.0	0.1	0.3	0.5	0.8	1.2	1.7	2.1	2.6	3.1	3.7	4.3	5.0	5.6	6.2

Find the Time and Height differences & interpolate using the table below.

Ht. of Tide at 18 11

16 48 -1.0  
22 47 10.2

LW 16 48 0 12  
HW 22 47 05 47  
Time Diff. 05 59

LW 16 48 0 12  
Time of Tide 18 11 01 11  
Time Diff. 01 23

$$05\ 59 \left[ \begin{array}{l} 16\ 48 \\ 18\ 11 \\ 22\ 47 \end{array} \right. \begin{array}{l} 01\ 23 \\ \\ \end{array} \left. \begin{array}{l} -1.0 \\ \boxed{0.4} \\ 10.2 \end{array} \right] 11.2$$

Ht. of Tide at 09 33

07 54 11.6  
13 21 -0.3

HW 07 54 0 06  
LW 13 21 05 21  
Time Diff. 05 27

HW 07 54 0 06  
Time of Tide 09 33 01 33  
Time Diff. 01 39

$$05\ 27 \left[ \begin{array}{l} 07\ 54 \\ 09\ 33 \\ 13\ 21 \end{array} \right. \begin{array}{l} 01\ 39 \\ \\ \end{array} \left. \begin{array}{l} 11.6 \\ \boxed{9.1} \\ -0.3 \end{array} \right] 11.9$$

Ht. of Tide at 16 17

12 48 11.2  
17 52 -0.7

HW 12 48 0 12  
LW 17 52 04 52  
Time Diff. 05 04

Time of Tide 16 17 0 43  
LW 17 52 00 52  
Time Diff. 01 35

$$05\ 04 \left[ \begin{array}{l} 12\ 48 \\ 16\ 17 \\ 17\ 52 \end{array} \right. \begin{array}{l} 01\ 35 \\ \\ \end{array} \left. \begin{array}{l} 11.2 \\ \boxed{1.8} \\ -0.7 \end{array} \right] 11.9$$

Ht. of Tide at 18 54

16 43 10.6  
23 00 0.0

HW 16 43 0 17  
LW 23 00 06 00  
Time Diff. 06 17

HW 16 43 0 17  
Time of Tide 18 54 01 54  
Time Diff. 02 11

$$06\ 17 \left[ \begin{array}{l} 16\ 43 \\ 18\ 54 \\ 23\ 00 \end{array} \right. \begin{array}{l} 02\ 11 \\ \\ \end{array} \left. \begin{array}{l} 10.6 \\ \boxed{8.0} \\ 0.0 \end{array} \right] 10.6$$

5 00	0 10	0 20	0 30	0 40	0 50	1 00	1 10	1 20	1 30	1 40	1 50	2 00	2 10	2 20	2 30
5 20	0 11	0 21	0 32	0 43	0 53	1 04	1 15	1 25	1 35	1 47	1 57	2 08	2 19	2 29	2 40
5 40	0 11	0 23	0 34	0 45	0 57	1 08	1 19	1 31	1 42	1 53	2 05	2 15	2 27	2 39	2 50
6 00	0 12	0 24	0 36	0 48	1 00	1 12	1 24	1 36	1 48	2 00	2 12	2 24	2 36	2 48	3 00
6 20	0 13	0 25	0 38	0 51	1 03	1 16	1 29	1 41	1 54	2 07	2 19	2 32	2 45	2 57	3 10
6 40	0 13	0 27	0 40	0 53	1 07	1 20	1 33	1 47	2 00	2 13	2 27	2 40	2 53	3 07	3 20
7 00	0 14	0 28	0 42	0 56	1 10	1 24	1 38	1 52	2 06	2 20	2 34	2 48	3 02	3 16	3 30
5.5	0.0	0.1	0.1	0.2	0.4	0.5	0.7	0.9	1.1	1.4	1.6	1.9	2.2	2.5	2.8
6.0	0.0	0.1	0.1	0.3	0.4	0.6	0.8	1.0	1.2	1.5	1.8	2.1	2.4	2.7	3.0
6.5	0.0	0.1	0.2	0.3	0.4	0.6	0.8	1.1	1.3	1.6	1.9	2.2	2.6	2.9	3.2
7.0	0.0	0.1	0.2	0.3	0.5	0.7	0.9	1.2	1.4	1.8	2.1	2.4	2.8	3.1	3.5
7.5	0.0	0.1	0.2	0.3	0.5	0.7	1.0	1.2	1.5	1.9	2.2	2.6	3.0	3.4	3.8
8.0	0.0	0.1	0.2	0.3	0.5	0.8	1.0	1.3	1.6	2.0	2.4	2.8	3.2	3.6	4.0
8.5	0.0	0.1	0.2	0.4	0.6	0.8	1.1	1.4	1.8	2.1	2.5	2.9	3.4	3.8	4.2
9.0	0.0	0.1	0.2	0.4	0.6	0.9	1.2	1.5	1.9	2.2	2.7	3.1	3.6	4.0	4.5
9.5	0.0	0.1	0.2	0.4	0.6	0.9	1.2	1.6	2.0	2.4	2.8	3.3	3.8	4.3	4.8
10.0	0.0	0.1	0.2	0.4	0.7	1.0	1.3	1.8	2.1	2.5	3.0	3.5	4.0	4.5	5.0
10.5	0.0	0.1	0.3	0.5	0.7	1.0	1.3	1.7	2.2	2.6	3.1	3.6	4.2	4.7	5.2
11.0	0.0	0.1	0.3	0.5	0.7	1.1	1.4	1.8	2.3	2.8	3.3	3.8	4.4	4.9	5.5
11.5	0.0	0.1	0.3	0.5	0.8	1.1	1.5	1.9	2.4	2.9	3.4	4.0	4.6	5.1	5.8
12.0	0.0	0.1	0.3	0.5	0.8	1.1	1.6	2.0	2.5	3.0	3.6	4.1	4.8	5.4	6.0
12.5	0.0	0.1	0.3	0.5	0.8	1.2	1.7	2.1	2.6	3.1	3.7	4.3	5.0	5.6	6.2

Find the Difference of Latitude in degrees and convert it to Difference of Latitude in minutes.

$$\begin{array}{r} \text{L1 } 00^\circ - 23.7' \text{ N} \\ \text{L2 } 02^\circ - 44.8' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 09^\circ - 21.8' \text{ N} \\ \text{L2 } 04^\circ - 43.9' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 13^\circ - 26.7' \text{ N} \\ \text{L2 } 14^\circ - 19.3' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 09^\circ - 15.6' \text{ S} \\ \text{L2 } 41^\circ - 40.1' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 29^\circ - 05.5' \text{ S} \\ \text{L2 } 48^\circ - 45.0' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 64^\circ - 39.4' \text{ N} \\ \text{L2 } 01^\circ - 13.2' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 58^\circ - 06.3' \text{ N} \\ \text{L2 } 48^\circ - 35.5' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 04^\circ - 41.7' \text{ S} \\ \text{L2 } 26^\circ - 26.0' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 58^\circ - 47.6' \text{ S} \\ \text{L2 } 33^\circ - 04.4' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 31^\circ - 05.7' \text{ S} \\ \text{L2 } 51^\circ - 11.1' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 46^\circ - 07.9' \text{ N} \\ \text{L2 } 65^\circ - 21.4' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 33^\circ - 22.3' \text{ S} \\ \text{L2 } 68^\circ - 33.8' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 28^\circ - 01.4' \text{ S} \\ \text{L2 } 69^\circ - 39.2' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 13^\circ - 02.9' \text{ S} \\ \text{L2 } 45^\circ - 52.5' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 31^\circ - 28.9' \text{ S} \\ \text{L2 } 63^\circ - 08.8' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 60^\circ - 54.0' \text{ S} \\ \text{L2 } 24^\circ - 08.5' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 23^\circ - 31.6' \text{ S} \\ \text{L2 } 25^\circ - 25.9' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 02^\circ - 26.6' \text{ S} \\ \text{L2 } 01^\circ - 16.0' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 53^\circ - 30.8' \text{ S} \\ \text{L2 } 54^\circ - 27.0' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 25^\circ - 19.9' \text{ N} \\ \text{L2 } 31^\circ - 56.4' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 19^\circ - 32.0' \text{ N} \\ \text{L2 } 24^\circ - 02.8' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 01^\circ - 04.4' \text{ S} \\ \text{L2 } 30^\circ - 39.7' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 39^\circ - 57.0' \text{ N} \\ \text{L2 } 11^\circ - 26.4' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 52^\circ - 01.4' \text{ S} \\ \text{L2 } 30^\circ - 56.5' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 09^\circ - 50.4' \text{ S} \\ \text{L2 } 22^\circ - 51.2' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 44^\circ - 01.6' \text{ S} \\ \text{L2 } 19^\circ - 47.0' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 62^\circ - 21.6' \text{ S} \\ \text{L2 } 36^\circ - 48.9' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 11^\circ - 47.2' \text{ S} \\ \text{L2 } 43^\circ - 13.5' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 06^\circ - 48.7' \text{ S} \\ \text{L2 } 06^\circ - 39.0' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 29^\circ - 02.2' \text{ S} \\ \text{L2 } 39^\circ - 41.7' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 26^\circ - 52.6' \text{ S} \\ \text{L2 } 18^\circ - 44.8' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 09^\circ - 38.6' \text{ S} \\ \text{L2 } 32^\circ - 33.1' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 50^\circ - 05.7' \text{ N} \\ \text{L2 } 11^\circ - 20.9' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 11^\circ - 09.9' \text{ S} \\ \text{L2 } 60^\circ - 05.2' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 10^\circ - 18.3' \text{ N} \\ \text{L2 } 03^\circ - 18.4' \text{ S} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

$$\begin{array}{r} \text{L1 } 50^\circ - 40.7' \text{ N} \\ \text{L2 } 37^\circ - 27.1' \text{ N} \\ \hline \ell^\circ \\ \hline \ell' \end{array}$$

Find the Difference of Latitude in degrees and convert it to Difference of Latitude in minutes.

$$\begin{array}{r} \text{L1} \quad 00^\circ - 23.7' \text{ N} \\ \text{L2} \quad 02^\circ - 44.8' \text{ N} \\ \hline \ell^\circ \quad 02^\circ - 21.0' \text{ N} \\ \hline \ell' \quad \quad \quad 141.0' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 09^\circ - 21.8' \text{ N} \\ \text{L2} \quad 04^\circ - 43.9' \text{ S} \\ \hline \ell^\circ \quad 14^\circ - 05.7' \text{ S} \\ \hline \ell' \quad \quad \quad 845.7' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 13^\circ - 26.7' \text{ N} \\ \text{L2} \quad 14^\circ - 19.3' \text{ S} \\ \hline \ell^\circ \quad 27^\circ - 46.0' \text{ S} \\ \hline \ell' \quad \quad \quad 1666.0' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 09^\circ - 15.6' \text{ S} \\ \text{L2} \quad 41^\circ - 40.1' \text{ N} \\ \hline \ell^\circ \quad 50^\circ - 55.7' \text{ N} \\ \hline \ell' \quad \quad \quad 3055.7' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 29^\circ - 05.5' \text{ S} \\ \text{L2} \quad 48^\circ - 45.0' \text{ S} \\ \hline \ell^\circ \quad 19^\circ - 39.6' \text{ S} \\ \hline \ell' \quad \quad \quad 1179.6' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 64^\circ - 39.4' \text{ N} \\ \text{L2} \quad 01^\circ - 13.2' \text{ N} \\ \hline \ell^\circ \quad 63^\circ - 26.3' \text{ S} \\ \hline \ell' \quad \quad \quad 3806.3' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 58^\circ - 06.3' \text{ N} \\ \text{L2} \quad 48^\circ - 35.5' \text{ N} \\ \hline \ell^\circ \quad 09^\circ - 30.8' \text{ S} \\ \hline \ell' \quad \quad \quad 570.8' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 04^\circ - 41.7' \text{ S} \\ \text{L2} \quad 26^\circ - 26.0' \text{ S} \\ \hline \ell^\circ \quad 21^\circ - 44.4' \text{ S} \\ \hline \ell' \quad \quad \quad 1304.4' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 58^\circ - 47.6' \text{ S} \\ \text{L2} \quad 33^\circ - 04.4' \text{ N} \\ \hline \ell^\circ \quad 91^\circ - 52.0' \text{ N} \\ \hline \ell' \quad \quad \quad 5512.0' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 31^\circ - 05.7' \text{ S} \\ \text{L2} \quad 51^\circ - 11.1' \text{ N} \\ \hline \ell^\circ \quad 82^\circ - 16.7' \text{ N} \\ \hline \ell' \quad \quad \quad 4936.7' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 46^\circ - 07.9' \text{ N} \\ \text{L2} \quad 65^\circ - 21.4' \text{ N} \\ \hline \ell^\circ \quad 19^\circ - 13.5' \text{ N} \\ \hline \ell' \quad \quad \quad 1153.5' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 33^\circ - 22.3' \text{ S} \\ \text{L2} \quad 68^\circ - 33.8' \text{ S} \\ \hline \ell^\circ \quad 35^\circ - 11.5' \text{ S} \\ \hline \ell' \quad \quad \quad 2111.5' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 28^\circ - 01.4' \text{ S} \\ \text{L2} \quad 69^\circ - 39.2' \text{ S} \\ \hline \ell^\circ \quad 41^\circ - 37.7' \text{ S} \\ \hline \ell' \quad \quad \quad 2497.7' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 13^\circ - 02.9' \text{ S} \\ \text{L2} \quad 45^\circ - 52.5' \text{ N} \\ \hline \ell^\circ \quad 58^\circ - 55.4' \text{ N} \\ \hline \ell' \quad \quad \quad 3535.4' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 31^\circ - 28.9' \text{ S} \\ \text{L2} \quad 63^\circ - 08.8' \text{ N} \\ \hline \ell^\circ \quad 94^\circ - 37.7' \text{ N} \\ \hline \ell' \quad \quad \quad 5677.7' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 60^\circ - 54.0' \text{ S} \\ \text{L2} \quad 24^\circ - 08.5' \text{ N} \\ \hline \ell^\circ \quad 85^\circ - 02.5' \text{ N} \\ \hline \ell' \quad \quad \quad 5102.5' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 23^\circ - 31.6' \text{ S} \\ \text{L2} \quad 25^\circ - 25.9' \text{ N} \\ \hline \ell^\circ \quad 48^\circ - 57.5' \text{ N} \\ \hline \ell' \quad \quad \quad 2937.5' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 02^\circ - 26.6' \text{ S} \\ \text{L2} \quad 01^\circ - 16.0' \text{ S} \\ \hline \ell^\circ \quad 01^\circ - 10.5' \text{ N} \\ \hline \ell' \quad \quad \quad 70.5' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 53^\circ - 30.8' \text{ S} \\ \text{L2} \quad 54^\circ - 27.0' \text{ S} \\ \hline \ell^\circ \quad 00^\circ - 56.2' \text{ S} \\ \hline \ell' \quad \quad \quad 56.2' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 25^\circ - 19.9' \text{ N} \\ \text{L2} \quad 31^\circ - 56.4' \text{ S} \\ \hline \ell^\circ \quad 57^\circ - 16.3' \text{ S} \\ \hline \ell' \quad \quad \quad 3436.3' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 19^\circ - 32.0' \text{ N} \\ \text{L2} \quad 24^\circ - 02.8' \text{ N} \\ \hline \ell^\circ \quad 04^\circ - 30.8' \text{ N} \\ \hline \ell' \quad \quad \quad 270.8' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 01^\circ - 04.4' \text{ S} \\ \text{L2} \quad 30^\circ - 39.7' \text{ S} \\ \hline \ell^\circ \quad 29^\circ - 35.3' \text{ S} \\ \hline \ell' \quad \quad \quad 1775.3' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 39^\circ - 57.0' \text{ N} \\ \text{L2} \quad 11^\circ - 26.4' \text{ N} \\ \hline \ell^\circ \quad 28^\circ - 30.6' \text{ S} \\ \hline \ell' \quad \quad \quad 1710.6' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 52^\circ - 01.4' \text{ S} \\ \text{L2} \quad 30^\circ - 56.5' \text{ S} \\ \hline \ell^\circ \quad 21^\circ - 04.9' \text{ N} \\ \hline \ell' \quad \quad \quad 1264.9' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 09^\circ - 50.4' \text{ S} \\ \text{L2} \quad 22^\circ - 51.2' \text{ N} \\ \hline \ell^\circ \quad 32^\circ - 41.6' \text{ N} \\ \hline \ell' \quad \quad \quad 1961.6' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 44^\circ - 01.6' \text{ S} \\ \text{L2} \quad 19^\circ - 47.0' \text{ S} \\ \hline \ell^\circ \quad 24^\circ - 14.6' \text{ N} \\ \hline \ell' \quad \quad \quad 1454.6' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 62^\circ - 21.6' \text{ S} \\ \text{L2} \quad 36^\circ - 48.9' \text{ S} \\ \hline \ell^\circ \quad 25^\circ - 32.7' \text{ N} \\ \hline \ell' \quad \quad \quad 1532.7' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 11^\circ - 47.2' \text{ S} \\ \text{L2} \quad 43^\circ - 13.5' \text{ N} \\ \hline \ell^\circ \quad 55^\circ - 00.7' \text{ N} \\ \hline \ell' \quad \quad \quad 3300.7' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 06^\circ - 48.7' \text{ S} \\ \text{L2} \quad 06^\circ - 39.0' \text{ N} \\ \hline \ell^\circ \quad 13^\circ - 27.7' \text{ N} \\ \hline \ell' \quad \quad \quad 807.7' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 29^\circ - 02.2' \text{ S} \\ \text{L2} \quad 39^\circ - 41.7' \text{ N} \\ \hline \ell^\circ \quad 68^\circ - 43.9' \text{ N} \\ \hline \ell' \quad \quad \quad 4123.9' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 26^\circ - 52.6' \text{ S} \\ \text{L2} \quad 18^\circ - 44.8' \text{ S} \\ \hline \ell^\circ \quad 08^\circ - 07.8' \text{ N} \\ \hline \ell' \quad \quad \quad 487.8' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 09^\circ - 38.6' \text{ S} \\ \text{L2} \quad 32^\circ - 33.1' \text{ S} \\ \hline \ell^\circ \quad 22^\circ - 54.5' \text{ S} \\ \hline \ell' \quad \quad \quad 1374.5' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 50^\circ - 05.7' \text{ N} \\ \text{L2} \quad 11^\circ - 20.9' \text{ S} \\ \hline \ell^\circ \quad 61^\circ - 26.5' \text{ S} \\ \hline \ell' \quad \quad \quad 3686.5' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 11^\circ - 09.9' \text{ S} \\ \text{L2} \quad 60^\circ - 05.2' \text{ N} \\ \hline \ell^\circ \quad 71^\circ - 15.1' \text{ N} \\ \hline \ell' \quad \quad \quad 4275.1' \text{ N} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 10^\circ - 18.3' \text{ N} \\ \text{L2} \quad 03^\circ - 18.4' \text{ S} \\ \hline \ell^\circ \quad 13^\circ - 36.8' \text{ S} \\ \hline \ell' \quad \quad \quad 816.8' \text{ S} \end{array}$$

$$\begin{array}{r} \text{L1} \quad 50^\circ - 40.7' \text{ N} \\ \text{L2} \quad 37^\circ - 27.1' \text{ N} \\ \hline \ell^\circ \quad 13^\circ - 13.6' \text{ S} \\ \hline \ell' \quad \quad \quad 793.6' \text{ S} \end{array}$$



Find the Difference of Longitude in degrees and convert it to Difference of Longitude in minutes.

$$\begin{array}{r} \lambda 1 \quad 098^\circ - \quad 43.6' \text{ W} \\ \lambda 2 \quad 129^\circ - \quad 50.6' \text{ W} \\ \text{Dlo}^\circ \quad \underline{31^\circ - \quad 07.0' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 1867.0' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 074^\circ - \quad 57.3' \text{ E} \\ \lambda 2 \quad 119^\circ - \quad 42.6' \text{ E} \\ \text{Dlo}^\circ \quad \underline{44^\circ - \quad 45.3' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 2685.3' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 166^\circ - \quad 53.5' \text{ W} \\ \lambda 2 \quad 158^\circ - \quad 24.0' \text{ E} \\ \text{Dlo}^\circ \quad \underline{34^\circ - \quad 42.5' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 2082.5' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 104^\circ - \quad 53.7' \text{ E} \\ \lambda 2 \quad 050^\circ - \quad 32.4' \text{ E} \\ \text{Dlo}^\circ \quad \underline{54^\circ - \quad 21.4' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 3261.4' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 050^\circ - \quad 51.9' \text{ E} \\ \lambda 2 \quad 098^\circ - \quad 33.5' \text{ E} \\ \text{Dlo}^\circ \quad \underline{47^\circ - \quad 41.6' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 2861.6' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 015^\circ - \quad 45.5' \text{ E} \\ \lambda 2 \quad 030^\circ - \quad 28.5' \text{ W} \\ \text{Dlo}^\circ \quad \underline{46^\circ - \quad 13.9' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 2773.9' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 179^\circ - \quad 17.5' \text{ W} \\ \lambda 2 \quad 150^\circ - \quad 28.1' \text{ W} \\ \text{Dlo}^\circ \quad \underline{28^\circ - \quad 49.4' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 1729.4' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 148^\circ - \quad 48.2' \text{ W} \\ \lambda 2 \quad 072^\circ - \quad 01.7' \text{ E} \\ \text{Dlo}^\circ \quad \underline{139^\circ - \quad 10.2' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 8350.2' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 072^\circ - \quad 53.8' \text{ W} \\ \lambda 2 \quad 177^\circ - \quad 20.8' \text{ W} \\ \text{Dlo}^\circ \quad \underline{104^\circ - \quad 27.1' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 6267.1' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 170^\circ - \quad 58.7' \text{ E} \\ \lambda 2 \quad 172^\circ - \quad 37.8' \text{ W} \\ \text{Dlo}^\circ \quad \underline{16^\circ - \quad 23.5' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 983.5' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 115^\circ - \quad 55.7' \text{ E} \\ \lambda 2 \quad 063^\circ - \quad 30.9' \text{ W} \\ \text{Dlo}^\circ \quad \underline{179^\circ - \quad 26.7' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 10766.7' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 173^\circ - \quad 18.2' \text{ W} \\ \lambda 2 \quad 085^\circ - \quad 46.1' \text{ W} \\ \text{Dlo}^\circ \quad \underline{87^\circ - \quad 32.1' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 5252.1' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 038^\circ - \quad 13.3' \text{ E} \\ \lambda 2 \quad 117^\circ - \quad 04.6' \text{ E} \\ \text{Dlo}^\circ \quad \underline{78^\circ - \quad 51.3' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 4731.3' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 153^\circ - \quad 07.1' \text{ E} \\ \lambda 2 \quad 014^\circ - \quad 52.5' \text{ W} \\ \text{Dlo}^\circ \quad \underline{167^\circ - \quad 59.6' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 10079.6' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 093^\circ - \quad 21.7' \text{ W} \\ \lambda 2 \quad 064^\circ - \quad 38.4' \text{ E} \\ \text{Dlo}^\circ \quad \underline{158^\circ - \quad 00.1' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 9480.1' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 122^\circ - \quad 14.1' \text{ W} \\ \lambda 2 \quad 168^\circ - \quad 19.8' \text{ W} \\ \text{Dlo}^\circ \quad \underline{46^\circ - \quad 05.7' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 2765.7' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 059^\circ - \quad 06.2' \text{ W} \\ \lambda 2 \quad 095^\circ - \quad 54.2' \text{ W} \\ \text{Dlo}^\circ \quad \underline{36^\circ - \quad 47.9' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 2207.9' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 059^\circ - \quad 05.7' \text{ E} \\ \lambda 2 \quad 099^\circ - \quad 20.6' \text{ W} \\ \text{Dlo}^\circ \quad \underline{158^\circ - \quad 26.3' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 9506.3' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 018^\circ - \quad 14.0' \text{ W} \\ \lambda 2 \quad 150^\circ - \quad 35.6' \text{ W} \\ \text{Dlo}^\circ \quad \underline{132^\circ - \quad 21.6' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 7941.6' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 148^\circ - \quad 41.8' \text{ E} \\ \lambda 2 \quad 116^\circ - \quad 56.5' \text{ E} \\ \text{Dlo}^\circ \quad \underline{31^\circ - \quad 45.4' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 1905.4' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 170^\circ - \quad 48.1' \text{ E} \\ \lambda 2 \quad 025^\circ - \quad 53.7' \text{ W} \\ \text{Dlo}^\circ \quad \underline{163^\circ - \quad 18.2' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 9798.2' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 048^\circ - \quad 16.4' \text{ W} \\ \lambda 2 \quad 019^\circ - \quad 56.2' \text{ W} \\ \text{Dlo}^\circ \quad \underline{28^\circ - \quad 20.1' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 1700.1' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 036^\circ - \quad 46.7' \text{ E} \\ \lambda 2 \quad 155^\circ - \quad 12.6' \text{ E} \\ \text{Dlo}^\circ \quad \underline{118^\circ - \quad 25.9' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 7105.9' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 020^\circ - \quad 12.6' \text{ W} \\ \lambda 2 \quad 097^\circ - \quad 58.1' \text{ E} \\ \text{Dlo}^\circ \quad \underline{118^\circ - \quad 10.7' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 7090.7' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 059^\circ - \quad 11.9' \text{ E} \\ \lambda 2 \quad 162^\circ - \quad 47.6' \text{ E} \\ \text{Dlo}^\circ \quad \underline{103^\circ - \quad 35.8' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 6215.8' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 004^\circ - \quad 33.8' \text{ E} \\ \lambda 2 \quad 109^\circ - \quad 07.3' \text{ E} \\ \text{Dlo}^\circ \quad \underline{104^\circ - \quad 33.5' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 6273.5' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 141^\circ - \quad 10.5' \text{ E} \\ \lambda 2 \quad 010^\circ - \quad 45.9' \text{ E} \\ \text{Dlo}^\circ \quad \underline{130^\circ - \quad 24.6' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 7824.6' \text{ W}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 019^\circ - \quad 41.5' \text{ E} \\ \lambda 2 \quad 047^\circ - \quad 33.7' \text{ E} \\ \text{Dlo}^\circ \quad \underline{27^\circ - \quad 52.2' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 1672.2' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 078^\circ - \quad 56.6' \text{ E} \\ \lambda 2 \quad 132^\circ - \quad 12.5' \text{ W} \\ \text{Dlo}^\circ \quad \underline{148^\circ - \quad 50.9' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 8930.9' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 059^\circ - \quad 02.9' \text{ W} \\ \lambda 2 \quad 028^\circ - \quad 49.6' \text{ E} \\ \text{Dlo}^\circ \quad \underline{87^\circ - \quad 52.5' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 5272.5' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 157^\circ - \quad 49.3' \text{ E} \\ \lambda 2 \quad 163^\circ - \quad 53.2' \text{ E} \\ \text{Dlo}^\circ \quad \underline{06^\circ - \quad 03.9' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 363.9' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 089^\circ - \quad 04.5' \text{ W} \\ \lambda 2 \quad 008^\circ - \quad 32.6' \text{ W} \\ \text{Dlo}^\circ \quad \underline{80^\circ - \quad 31.8' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 4831.8' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 139^\circ - \quad 40.2' \text{ W} \\ \lambda 2 \quad 033^\circ - \quad 38.0' \text{ E} \\ \text{Dlo}^\circ \quad \underline{173^\circ - \quad 18.2' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 10398.2' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 077^\circ - \quad 05.5' \text{ E} \\ \lambda 2 \quad 139^\circ - \quad 37.4' \text{ E} \\ \text{Dlo}^\circ \quad \underline{62^\circ - \quad 31.8' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 3751.8' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 050^\circ - \quad 33.6' \text{ W} \\ \lambda 2 \quad 046^\circ - \quad 12.9' \text{ E} \\ \text{Dlo}^\circ \quad \underline{96^\circ - \quad 46.5' \text{ E}} \\ \text{Dlo}' \quad \underline{\quad \quad 5806.5' \text{ E}} \end{array}$$

$$\begin{array}{r} \lambda 1 \quad 033^\circ - \quad 47.2' \text{ W} \\ \lambda 2 \quad 147^\circ - \quad 32.3' \text{ W} \\ \text{Dlo}^\circ \quad \underline{113^\circ - \quad 45.1' \text{ W}} \\ \text{Dlo}' \quad \underline{\quad \quad 6825.1' \text{ W}} \end{array}$$



## Find the Mid-Latitude

$$\begin{array}{l} 1. \text{ L1} \quad 43^\circ - 36.0' \text{ N} \\ \quad \text{L2} \quad 3^\circ - 36.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 2. \text{ L1} \quad 43^\circ - 12.0' \text{ S} \\ \quad \text{L2} \quad 51^\circ - 00.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 3. \text{ L1} \quad 38^\circ - 24.0' \text{ N} \\ \quad \text{L2} \quad 38^\circ - 24.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 4. \text{ L1} \quad 38^\circ - 18.0' \text{ N} \\ \quad \text{L2} \quad 24^\circ - 48.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 5. \text{ L1} \quad 12^\circ - 00.0' \text{ S} \\ \quad \text{L2} \quad 58^\circ - 00.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 6. \text{ L1} \quad 65^\circ - 24.0' \text{ N} \\ \quad \text{L2} \quad 3^\circ - 12.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 7. \text{ L1} \quad 41^\circ - 00.0' \text{ N} \\ \quad \text{L2} \quad 3^\circ - 18.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 8. \text{ L1} \quad 1^\circ - 42.0' \text{ N} \\ \quad \text{L2} \quad 79^\circ - 42.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 9. \text{ L1} \quad 42^\circ - 42.0' \text{ N} \\ \quad \text{L2} \quad 53^\circ - 36.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 10. \text{ L1} \quad 9^\circ - 24.0' \text{ N} \\ \quad \text{L2} \quad 75^\circ - 00.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 11. \text{ L1} \quad 74^\circ - 54.0' \text{ S} \\ \quad \text{L2} \quad 21^\circ - 18.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 12. \text{ L1} \quad 6^\circ - 18.0' \text{ N} \\ \quad \text{L2} \quad 52^\circ - 42.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 13. \text{ L1} \quad 66^\circ - 18.0' \text{ N} \\ \quad \text{L2} \quad 69^\circ - 18.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 14. \text{ L1} \quad 29^\circ - 36.0' \text{ N} \\ \quad \text{L2} \quad 52^\circ - 42.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 15. \text{ L1} \quad 10^\circ - 06.0' \text{ S} \\ \quad \text{L2} \quad 52^\circ - 06.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 16. \text{ L1} \quad 42^\circ - 00.0' \text{ S} \\ \quad \text{L2} \quad 82^\circ - 42.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 17. \text{ L1} \quad 14^\circ - 06.0' \text{ S} \\ \quad \text{L2} \quad 13^\circ - 00.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 18. \text{ L1} \quad 79^\circ - 54.0' \text{ S} \\ \quad \text{L2} \quad 89^\circ - 36.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 19. \text{ L1} \quad 77^\circ - 30.0' \text{ N} \\ \quad \text{L2} \quad 73^\circ - 30.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 20. \text{ L1} \quad 82^\circ - 30.0' \text{ S} \\ \quad \text{L2} \quad 25^\circ - 12.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 21. \text{ L1} \quad 65^\circ - 06.0' \text{ N} \\ \quad \text{L2} \quad 1^\circ - 12.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 22. \text{ L1} \quad 1^\circ - 12.0' \text{ N} \\ \quad \text{L2} \quad 70^\circ - 36.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 23. \text{ L1} \quad 15^\circ - 54.0' \text{ N} \\ \quad \text{L2} \quad 44^\circ - 06.0' \text{ N} \end{array}$$

Lm

$$\begin{array}{l} 24. \text{ L1} \quad 21^\circ - 06.0' \text{ S} \\ \quad \text{L2} \quad 29^\circ - 42.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 25. \text{ L1} \quad 52^\circ - 36.0' \text{ S} \\ \quad \text{L2} \quad 56^\circ - 12.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 26. \text{ L1} \quad 39^\circ - 48.0' \text{ S} \\ \quad \text{L2} \quad 28^\circ - 24.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 27. \text{ L1} \quad 7^\circ - 12.0' \text{ S} \\ \quad \text{L2} \quad 83^\circ - 54.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 28. \text{ L1} \quad 76^\circ - 54.0' \text{ S} \\ \quad \text{L2} \quad 51^\circ - 54.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 29. \text{ L1} \quad 40^\circ - 06.0' \text{ S} \\ \quad \text{L2} \quad 7^\circ - 36.0' \text{ S} \end{array}$$

Lm

$$\begin{array}{l} 30. \text{ L1} \quad 87^\circ - 48.0' \text{ S} \\ \quad \text{L2} \quad 22^\circ - 54.0' \text{ S} \end{array}$$

Lm

## Find the Mid-Latitude

$$\begin{array}{r} 1. \text{ L1} \quad 43^\circ - 36.0' \text{ N} \\ \text{L2} \quad 3^\circ - 36.0' \text{ N} \\ \hline \end{array}$$

$$43 + 36 / 60 + 3 + 36 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{23^\circ - 36.0' \text{ N}}$$

$$\begin{array}{r} 2. \text{ L1} \quad 43^\circ - 12.0' \text{ S} \\ \text{L2} \quad 51^\circ - 00.0' \text{ S} \\ \hline \end{array}$$

$$43 + 12 / 60 + 51 + 0 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{47^\circ - 06.0' \text{ S}}$$

$$\begin{array}{r} 3. \text{ L1} \quad 38^\circ - 24.0' \text{ N} \\ \text{L2} \quad 38^\circ - 24.0' \text{ N} \\ \hline \end{array}$$

$$38 + 24 / 60 + 38 + 24 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{38^\circ - 24.0' \text{ N}}$$

$$\begin{array}{r} 4. \text{ L1} \quad 38^\circ - 18.0' \text{ N} \\ \text{L2} \quad 24^\circ - 48.0' \text{ N} \\ \hline \end{array}$$

$$38 + 18 / 60 + 24 + 48 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{31^\circ - 33.0' \text{ N}}$$

$$\begin{array}{r} 5. \text{ L1} \quad 12^\circ - 00.0' \text{ S} \\ \text{L2} \quad 58^\circ - 00.0' \text{ S} \\ \hline \end{array}$$

$$12 + 0 / 60 + 58 + 0 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{35^\circ - 00.0' \text{ S}}$$

$$\begin{array}{r} 6. \text{ L1} \quad 65^\circ - 24.0' \text{ N} \\ \text{L2} \quad 3^\circ - 12.0' \text{ N} \\ \hline \end{array}$$

$$65 + 24 / 60 + 3 + 12 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{34^\circ - 18.0' \text{ N}}$$

$$\begin{array}{r} 7. \text{ L1} \quad 41^\circ - 00.0' \text{ N} \\ \text{L2} \quad 3^\circ - 18.0' \text{ N} \\ \hline \end{array}$$

$$41 + 0 / 60 + 3 + 18 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{22^\circ - 09.0' \text{ N}}$$

$$\begin{array}{r} 8. \text{ L1} \quad 1^\circ - 42.0' \text{ N} \\ \text{L2} \quad 79^\circ - 42.0' \text{ N} \\ \hline \end{array}$$

$$1 + 42 / 60 + 79 + 42 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{40^\circ - 42.0' \text{ N}}$$

$$\begin{array}{r} 9. \text{ L1} \quad 42^\circ - 42.0' \text{ N} \\ \text{L2} \quad 53^\circ - 36.0' \text{ N} \\ \hline \end{array}$$

$$42 + 42 / 60 + 53 + 36 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{48^\circ - 09.0' \text{ N}}$$

$$\begin{array}{r} 10. \text{ L1} \quad 9^\circ - 24.0' \text{ N} \\ \text{L2} \quad 75^\circ - 00.0' \text{ N} \\ \hline \end{array}$$

$$9 + 24 / 60 + 75 + 0 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{42^\circ - 12.0' \text{ N}}$$

$$\begin{array}{r} 11. \text{ L1} \quad 74^\circ - 54.0' \text{ S} \\ \text{L2} \quad 21^\circ - 18.0' \text{ S} \\ \hline \end{array}$$

$$74 + 54 / 60 + 21 + 18 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{48^\circ - 06.0' \text{ S}}$$

$$\begin{array}{r} 12. \text{ L1} \quad 6^\circ - 18.0' \text{ N} \\ \text{L2} \quad 52^\circ - 42.0' \text{ N} \\ \hline \end{array}$$

$$6 + 18 / 60 + 52 + 42 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{29^\circ - 30.0' \text{ N}}$$

$$\begin{array}{r} 13. \text{ L1} \quad 66^\circ - 18.0' \text{ N} \\ \text{L2} \quad 69^\circ - 18.0' \text{ N} \\ \hline \end{array}$$

$$66 + 18 / 60 + 69 + 18 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{67^\circ - 48.0' \text{ N}}$$

$$\begin{array}{r} 14. \text{ L1} \quad 29^\circ - 36.0' \text{ N} \\ \text{L2} \quad 52^\circ - 42.0' \text{ N} \\ \hline \end{array}$$

$$29 + 36 / 60 + 52 + 42 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{41^\circ - 09.0' \text{ N}}$$

$$\begin{array}{r} 15. \text{ L1} \quad 10^\circ - 06.0' \text{ S} \\ \text{L2} \quad 52^\circ - 06.0' \text{ S} \\ \hline \end{array}$$

$$10 + 6 / 60 + 52 + 6 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{31^\circ - 06.0' \text{ S}}$$

$$\begin{array}{r} 16. \text{ L1} \quad 42^\circ - 00.0' \text{ S} \\ \text{L2} \quad 82^\circ - 42.0' \text{ S} \\ \hline \end{array}$$

$$42 + 0 / 60 + 82 + 42 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{62^\circ - 21.0' \text{ S}}$$

$$\begin{array}{r} 17. \text{ L1} \quad 14^\circ - 06.0' \text{ S} \\ \text{L2} \quad 13^\circ - 00.0' \text{ S} \\ \hline \end{array}$$

$$14 + 6 / 60 + 13 + 0 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{13^\circ - 33.0' \text{ S}}$$

$$\begin{array}{r} 18. \text{ L1} \quad 79^\circ - 54.0' \text{ S} \\ \text{L2} \quad 89^\circ - 36.0' \text{ S} \\ \hline \end{array}$$

$$79 + 54 / 60 + 89 + 36 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{84^\circ - 45.0' \text{ S}}$$

$$\begin{array}{r} 19. \text{ L1} \quad 77^\circ - 30.0' \text{ N} \\ \text{L2} \quad 73^\circ - 30.0' \text{ N} \\ \hline \end{array}$$

$$77 + 30 / 60 + 73 + 30 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{75^\circ - 30.0' \text{ N}}$$

$$\begin{array}{r} 20. \text{ L1} \quad 82^\circ - 30.0' \text{ S} \\ \text{L2} \quad 25^\circ - 12.0' \text{ S} \\ \hline \end{array}$$

$$82 + 30 / 60 + 25 + 12 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{53^\circ - 51.0' \text{ S}}$$

$$\begin{array}{r} 21. \text{ L1} \quad 65^\circ - 06.0' \text{ N} \\ \text{L2} \quad 1^\circ - 12.0' \text{ N} \\ \hline \end{array}$$

$$65 + 6 / 60 + 1 + 12 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{33^\circ - 09.0' \text{ N}}$$

$$\begin{array}{r} 22. \text{ L1} \quad 1^\circ - 12.0' \text{ N} \\ \text{L2} \quad 70^\circ - 36.0' \text{ N} \\ \hline \end{array}$$

$$1 + 12 / 60 + 70 + 36 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{35^\circ - 54.0' \text{ N}}$$

$$\begin{array}{r} 23. \text{ L1} \quad 15^\circ - 54.0' \text{ N} \\ \text{L2} \quad 44^\circ - 06.0' \text{ N} \\ \hline \end{array}$$

$$15 + 54 / 60 + 44 + 6 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{30^\circ - 00.0' \text{ N}}$$

$$\begin{array}{r} 24. \text{ L1} \quad 21^\circ - 06.0' \text{ S} \\ \text{L2} \quad 29^\circ - 42.0' \text{ S} \\ \hline \end{array}$$

$$21 + 6 / 60 + 29 + 42 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{25^\circ - 24.0' \text{ S}}$$

$$\begin{array}{r} 25. \text{ L1} \quad 52^\circ - 36.0' \text{ S} \\ \text{L2} \quad 56^\circ - 12.0' \text{ S} \\ \hline \end{array}$$

$$52 + 36 / 60 + 56 + 12 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{54^\circ - 24.0' \text{ S}}$$

$$\begin{array}{r} 26. \text{ L1} \quad 39^\circ - 48.0' \text{ S} \\ \text{L2} \quad 28^\circ - 24.0' \text{ S} \\ \hline \end{array}$$

$$39 + 48 / 60 + 28 + 24 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{34^\circ - 06.0' \text{ S}}$$

$$\begin{array}{r} 27. \text{ L1} \quad 7^\circ - 12.0' \text{ S} \\ \text{L2} \quad 83^\circ - 54.0' \text{ S} \\ \hline \end{array}$$

$$7 + 12 / 60 + 83 + 54 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{45^\circ - 33.0' \text{ S}}$$

$$\begin{array}{r} 28. \text{ L3} \quad 76^\circ - 54.0' \text{ S} \\ \text{L4} \quad 51^\circ - 54.0' \text{ S} \\ \hline \end{array}$$

$$76 + 54 / 60 + 51 + 54 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{64^\circ - 24.0' \text{ S}}$$

$$\begin{array}{r} 29. \text{ L5} \quad 40^\circ - 06.0' \text{ S} \\ \text{L6} \quad 7^\circ - 36.0' \text{ S} \\ \hline \end{array}$$

$$40 + 6 / 60 + 7 + 36 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{23^\circ - 51.0' \text{ S}}$$

$$\begin{array}{r} 30. \text{ L7} \quad 87^\circ - 48.0' \text{ S} \\ \text{L8} \quad 22^\circ - 54.0' \text{ S} \\ \hline \end{array}$$

$$87 + 48 / 60 + 22 + 54 / 60 = / 2$$

$$\text{Lm} \quad \mathbf{55^\circ - 21.0' \text{ S}}$$

Look-up the Meridional Parts (M) for each Latitude, interpolate and then find the meridional difference (m)

L1 0° - 09.6' S      M1  
 L2 50° - 41.9' N      M2 \_\_\_\_\_  
 ℓ° \_\_\_\_\_  
 ℓ' \_\_\_\_\_

L1 27° - 09.5' S      M1  
 L2 37° - 39.2' N      M2 \_\_\_\_\_  
 ℓ° \_\_\_\_\_  
 ℓ' \_\_\_\_\_

$\left[ \begin{array}{l} \mathcal{L} \ 00^\circ - 9.0' \\ \mathcal{L}1 \ 00^\circ - 9.6' \\ \mathcal{L} \ 00^\circ - 10.0' \end{array} \right]$  X  $\left[ \begin{array}{l} M \ 8.9 \\ M1 \ ? \\ M \ 9.9 \end{array} \right]$   
 X = \_\_\_\_\_

$\left[ \begin{array}{l} \mathcal{L} \ 27^\circ - 9.0' \\ \mathcal{L}1 \ 27^\circ - 9.5' \\ \mathcal{L} \ 27^\circ - 10.0' \end{array} \right]$  X  $\left[ \begin{array}{l} M \\ M1 \ ? \\ M \end{array} \right]$   
 X = \_\_\_\_\_

\_\_\_\_\_ + \_\_\_\_\_ =

\_\_\_\_\_ + \_\_\_\_\_ =

$\left[ \begin{array}{l} \mathcal{L} \ 50^\circ - 41.0' \\ \mathcal{L}1 \ 50^\circ - 41.9' \\ \mathcal{L} \ 50^\circ - 42.0' \end{array} \right]$  0.9 Y  $\left[ \begin{array}{l} M \ 3520.9 \\ M2 \ ? \\ M \ 3522.5 \end{array} \right]$   
 Y = \_\_\_\_\_

$\left[ \begin{array}{l} \mathcal{L} \ 37^\circ - 39.0' \\ \mathcal{L}1 \ 37^\circ - 39.2' \\ \mathcal{L} \ 37^\circ - 40.0' \end{array} \right]$  0.2 Y  $\left[ \begin{array}{l} M \\ M2 \ ? \\ M \end{array} \right]$   
 Y = \_\_\_\_\_

\_\_\_\_\_ + \_\_\_\_\_ =

\_\_\_\_\_ + \_\_\_\_\_ =

L1 11° - 10.5' S      M1  
 L2 6° - 30.5' S      M2 \_\_\_\_\_  
 ℓ° \_\_\_\_\_  
 ℓ' \_\_\_\_\_

L1 25° - 13.8' N      M1  
 L2 4° - 37.1' N      M2 \_\_\_\_\_  
 ℓ° \_\_\_\_\_  
 ℓ' \_\_\_\_\_

$\left[ \begin{array}{l} \mathcal{L} \ 11^\circ - 10.0' \\ \mathcal{L}1 \ 11^\circ - 10.5' \\ \mathcal{L} \ 11^\circ - 11.0' \end{array} \right]$  X  $\left[ \begin{array}{l} M \\ M1 \ ? \\ M \end{array} \right]$   
 X = \_\_\_\_\_

$\left[ \begin{array}{l} \mathcal{L} \ 25^\circ - 13.0' \\ \mathcal{L}1 \ 25^\circ - 13.8' \\ \mathcal{L} \ 25^\circ - 14.0' \end{array} \right]$  X  $\left[ \begin{array}{l} M \\ M1 \ ? \\ M \end{array} \right]$   
 X = \_\_\_\_\_

\_\_\_\_\_ + \_\_\_\_\_ =

\_\_\_\_\_ + \_\_\_\_\_ =

$\left[ \begin{array}{l} \mathcal{L} \ 06^\circ - 30.0' \\ \mathcal{L}1 \ 06^\circ - 30.5' \\ \mathcal{L} \ 06^\circ - 31.0' \end{array} \right]$  0.5 Y  $\left[ \begin{array}{l} M \\ M2 \ ? \\ M \end{array} \right]$   
 Y = \_\_\_\_\_

$\left[ \begin{array}{l} \mathcal{L} \ 04^\circ - 37.0' \\ \mathcal{L}1 \ 04^\circ - 37.1' \\ \mathcal{L} \ 04^\circ - 38.0' \end{array} \right]$  0.1 Y  $\left[ \begin{array}{l} M \\ M2 \ ? \\ M \end{array} \right]$   
 Y = \_\_\_\_\_

\_\_\_\_\_ + \_\_\_\_\_ =

\_\_\_\_\_ + \_\_\_\_\_ =

Look-up the Meridional Parts (M) for each Latitude, interpolate and then find the meridional difference (m)

L1	0° - 09.6' S	M1	9.5
L2	50° - 41.9' N	M2	3522.3
ℓ°	<u>50° - 51.5' N</u>	m	<u>3531.8</u>
ℓ'	<u>3051.5' N</u>		

L1	27° - 09.5' S	M1	1683.7
L2	37° - 39.2' N	M2	2427.9
ℓ°	<u>64° - 48.7' N</u>	m	<u>4111.5</u>
ℓ'	<u>3888.7' N</u>		

$$1.0 \begin{bmatrix} \mathcal{L} & 00^\circ - 9.0' \\ \mathcal{L}1 & 00^\circ - 9.6' \\ \mathcal{L} & 00^\circ - 10.0' \end{bmatrix} \times 0.6 \times \begin{bmatrix} M & 8.9 \\ M1 & ? \\ M & 9.9 \end{bmatrix} 1.0$$

$$\frac{X}{1.0} = \frac{0.6}{1.0} \quad X = \frac{1 \times 0.6}{1.0}$$

$$1.0 \begin{bmatrix} \mathcal{L} & 27^\circ - 9.0' \\ \mathcal{L}1 & 27^\circ - 9.5' \\ \mathcal{L} & 27^\circ - 10.0' \end{bmatrix} \times 0.5 \times \begin{bmatrix} M & 1683.1 \\ M1 & ? \\ M & 1684.2 \end{bmatrix} 1.1$$

$$\frac{X}{1.1} = \frac{0.5}{1.0} \quad X = \frac{1.1 \times 0.5}{1.0}$$

$$8.9 + 0.6 = 9.5$$

$$1683.1 + 0.55 = 1683.7$$

$$1.0 \begin{bmatrix} \mathcal{L} & 50^\circ - 41.0' \\ \mathcal{L}1 & 50^\circ - 41.9' \\ \mathcal{L} & 50^\circ - 42.0' \end{bmatrix} \times 0.9 \times \begin{bmatrix} M & 3520.9 \\ M2 & ? \\ M & 3522.5 \end{bmatrix} 1.6$$

$$\frac{Y}{1.6} = \frac{0.9}{1.0} \quad Y = \frac{1.6 \times 0.9}{1.0}$$

$$1.0 \begin{bmatrix} \mathcal{L} & 37^\circ - 39.0' \\ \mathcal{L}1 & 37^\circ - 39.2' \\ \mathcal{L} & 37^\circ - 40.0' \end{bmatrix} \times 0.2 \times \begin{bmatrix} M & 2427.6 \\ M2 & ? \\ M & 2428.9 \end{bmatrix} 1.3$$

$$\frac{Y}{1.3} = \frac{0.2}{1.0} \quad Y = \frac{1.3 \times 0.2}{1.0}$$

$$3520.9 + 1.44 = 3522.3$$

$$2427.6 + 0.26 = 2427.9$$

L1	11° - 10.5' S	M1	670.3
L2	6° - 30.5' S	M2	388.7
ℓ°	<u>4° - 40.0' N</u>	m	<u>281.6</u>
ℓ'	<u>280.0' N</u>		

L1	25° - 13.8' N	M1	1555.4
L2	4° - 37.1' N	M2	275.5
ℓ°	<u>20° - 36.6' S</u>	m	<u>1279.9</u>
ℓ'	<u>1236.6' S</u>		

$$1.0 \begin{bmatrix} \mathcal{L} & 11^\circ - 10.0' \\ \mathcal{L}1 & 11^\circ - 10.5' \\ \mathcal{L} & 11^\circ - 11.0' \end{bmatrix} \times 0.5 \times \begin{bmatrix} M & 669.8 \\ M1 & ? \\ M & 670.8 \end{bmatrix} 1.0$$

$$\frac{X}{1.0} = \frac{0.5}{1.0} \quad X = \frac{1 \times 0.5}{1.0}$$

$$1.0 \begin{bmatrix} \mathcal{L} & 25^\circ - 13.0' \\ \mathcal{L}1 & 25^\circ - 13.8' \\ \mathcal{L} & 25^\circ - 14.0' \end{bmatrix} \times 0.8 \times \begin{bmatrix} M & 1554.5 \\ M1 & ? \\ M & 1555.6 \end{bmatrix} 1.1$$

$$\frac{X}{1.1} = \frac{0.8}{1.0} \quad X = \frac{1.1 \times 0.8}{1.0}$$

$$669.8 + 0.5 = 670.3$$

$$1554.5 + 0.88 = 1555.4$$

$$1.0 \begin{bmatrix} \mathcal{L} & 06^\circ - 30.0' \\ \mathcal{L}1 & 06^\circ - 30.5' \\ \mathcal{L} & 06^\circ - 31.0' \end{bmatrix} \times 0.5 \times \begin{bmatrix} M & 388.2 \\ M2 & ? \\ M & 389.2 \end{bmatrix} 1.0$$

$$\frac{Y}{1.0} = \frac{0.5}{1.0} \quad Y = \frac{1 \times 0.5}{1.0}$$

$$1.0 \begin{bmatrix} \mathcal{L} & 04^\circ - 37.0' \\ \mathcal{L}1 & 04^\circ - 37.1' \\ \mathcal{L} & 04^\circ - 38.0' \end{bmatrix} \times 0.1 \times \begin{bmatrix} M & 275.4 \\ M2 & ? \\ M & 276.4 \end{bmatrix} 1.0$$

$$\frac{Y}{1.0} = \frac{0.1}{1.0} \quad Y = \frac{1 \times 0.1}{1.0}$$

$$388.2 + 0.5 = 388.7$$

$$275.4 + 0.1 = 275.5$$

Find the Difference of Latitude in minutes and the meridional difference (m).

<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">L1 3° - 44.1' N</td> <td style="width: 50%;">M1</td> </tr> <tr> <td>L2 51° - 53.8' N</td> <td>M2</td> </tr> <tr> <td><math>\ell^\circ</math></td> <td>m</td> </tr> <tr> <td><math>\ell'</math></td> <td></td> </tr> </table>	L1 3° - 44.1' N	M1	L2 51° - 53.8' N	M2	$\ell^\circ$	m	$\ell'$		<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">L1 66° - 47.1' N</td> <td style="width: 50%;">M1</td> </tr> <tr> <td>L2 60° - 16.8' N</td> <td>M2</td> </tr> <tr> <td><math>\ell^\circ</math></td> <td>m</td> </tr> <tr> <td><math>\ell'</math></td> <td></td> </tr> </table>	L1 66° - 47.1' N	M1	L2 60° - 16.8' N	M2	$\ell^\circ$	m	$\ell'$		<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">L1 44° - 44.6' S</td> <td style="width: 50%;">M1</td> </tr> <tr> <td>L2 17° - 53.6' S</td> <td>M2</td> </tr> <tr> <td><math>\ell^\circ</math></td> <td>m</td> </tr> <tr> <td><math>\ell'</math></td> <td></td> </tr> </table>	L1 44° - 44.6' S	M1	L2 17° - 53.6' S	M2	$\ell^\circ$	m	$\ell'$	
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L1 30° - 10.8' N	M1																									
L2 63° - 58.6' N	M2																									
$\ell^\circ$	m																									
$\ell'$																										
L1 28° - 18.8' S	M1																									
L2 37° - 48.4' S	M2																									
$\ell^\circ$	m																									
$\ell'$																										
<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">L1 54° - 37.9' S</td> <td style="width: 50%;">M1</td> </tr> <tr> <td>L2 49° - 34.7' N</td> <td>M2</td> </tr> <tr> <td><math>\ell^\circ</math></td> <td>m</td> </tr> <tr> <td><math>\ell'</math></td> <td></td> </tr> </table>	L1 54° - 37.9' S	M1	L2 49° - 34.7' N	M2	$\ell^\circ$	m	$\ell'$		<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">L1 51° - 36.2' N</td> <td style="width: 50%;">M1</td> </tr> <tr> <td>L2 61° - 13.2' S</td> <td>M2</td> </tr> <tr> <td><math>\ell^\circ</math></td> <td>m</td> </tr> <tr> <td><math>\ell'</math></td> <td></td> </tr> </table>	L1 51° - 36.2' N	M1	L2 61° - 13.2' S	M2	$\ell^\circ$	m	$\ell'$		<table border="0" style="width: 100%;"> <tr> <td style="width: 50%;">L1 60° - 10.3' N</td> <td style="width: 50%;">M1</td> </tr> <tr> <td>L2 44° - 58.8' N</td> <td>M2</td> </tr> <tr> <td><math>\ell^\circ</math></td> <td>m</td> </tr> <tr> <td><math>\ell'</math></td> <td></td> </tr> </table>	L1 60° - 10.3' N	M1	L2 44° - 58.8' N	M2	$\ell^\circ$	m	$\ell'$	
L1 54° - 37.9' S	M1																									
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$\ell^\circ$	m																									
$\ell'$																										

Find the Difference of Latitude in minutes and the meridional difference (m).

L1 3° - 44.1' N	M1 222.8	L1 66° - 47.1' N	M1 5419.9	L1 44° - 44.6' S	M1 2992.0
L2 51° - 53.8' N	M2 3637.0	L2 60° - 16.8' N	M2 4541.1	L2 17° - 53.6' S	M2 1084.4
ℓ° 48° - 09.7' N	m 3414.2	ℓ° 6° - 30.3' S	m 878.9	ℓ° 26° - 51.0' N	m 1907.6
ℓ' 2889.7' N		ℓ' 390.3' S		ℓ' 1611.0' N	
L1 44° - 06.1' N	M1 2938.3	L1 2° - 53.8' S	M1 172.7	L1 64° - 49.1' S	M1 5132.2
L2 53° - 45.3' N	M2 3821.1	L2 35° - 09.2' N	M2 2242.3	L2 61° - 14.7' S	M2 4659.5
ℓ° 9° - 39.2' N	m 882.8	ℓ° 38° - 03.0' N	m 2415.0	ℓ° 3° - 34.4' N	m 472.8
ℓ' 579.2' N		ℓ' 2283.0' N		ℓ' 214.4' N	
L1 25° - 43.6' N	M1 1588.3	L1 38° - 33.1' S	M1 2496.1	L1 47° - 00.7' N	M1 3186.9
L2 44° - 48.8' S	M2 2997.9	L2 60° - 03.6' S	M2 4514.6	L2 2° - 55.9' N	M2 174.8
ℓ° 70° - 32.4' S	m 4586.1	ℓ° 21° - 30.5' S	m 2018.5	ℓ° 44° - 04.8' S	m 3012.1
ℓ' 4232.4' S		ℓ' 1290.5' S		ℓ' 2644.8' S	
L1 48° - 06.6' N	M1 3284.2	L1 45° - 38.2' N	M1 3067.8	L1 23° - 21.8' S	M1 1433.2
L2 15° - 32.5' N	M2 938.0	L2 42° - 04.6' N	M2 2772.5	L2 4° - 24.5' S	M2 263.0
ℓ° 32° - 34.2' S	m 2346.3	ℓ° 3° - 33.6' S	m 295.3	ℓ° 18° - 57.3' N	m 1170.2
ℓ' 1954.2' S		ℓ' 213.6' S		ℓ' 1137.3' N	
L1 26° - 34.1' S	M1 1644.2	L1 30° - 17.5' N	M1 1897.0	L1 19° - 20.7' N	M1 1175.8
L2 39° - 53.6' S	M2 2599.6	L2 25° - 14.5' N	M2 1556.2	L2 47° - 48.4' N	M2 3257.2
ℓ° 13° - 19.5' S	m 955.4	ℓ° 5° - 03.0' S	m 340.8	ℓ° 28° - 27.7' N	m 2081.4
ℓ' 799.5' S		ℓ' 303.0' S		ℓ' 1707.7' N	
L1 10° - 54.5' S	M1 654.1	L1 54° - 29.6' N	M1 3896.5	L1 44° - 41.1' N	M1 2987.1
L2 32° - 24.1' N	M2 2044.5	L2 69° - 32.3' S	M2 5864.2	L2 51° - 32.9' N	M2 3603.3
ℓ° 43° - 18.6' N	m 2698.7	ℓ° 124° - 01.9' S	m 9760.7	ℓ° 6° - 51.9' N	m 616.3
ℓ' 2598.6' N		ℓ' 7441.9' S		ℓ' 411.9' N	
L1 13° - 28.8' S	M1 811.0	L1 69° - 33.2' S	M1 5866.8	L1 57° - 32.9' N	M1 4224.0
L2 55° - 09.6' S	M2 3965.8	L2 59° - 23.1' N	M2 4434.4	L2 17° - 46.6' S	M2 1077.1
ℓ° 41° - 40.8' S	m 3154.8	ℓ° 128° - 56.3' N	m 10301.2	ℓ° 75° - 19.5' S	m 5301.1
ℓ' 2500.8' S		ℓ' 7736.3' N		ℓ' 4519.5' S	
L1 36° - 27.1' S	M1 2337.9	L1 30° - 10.8' N	M1 1889.3	L1 28° - 18.8' S	M1 1761.6
L2 64° - 05.6' S	M2 5031.5	L2 63° - 58.6' N	M2 5015.5	L2 37° - 48.4' S	M2 2439.4
ℓ° 27° - 38.5' S	m 2693.6	ℓ° 33° - 47.8' N	m 3126.2	ℓ° 9° - 29.6' S	m 677.9
ℓ' 1658.5' S		ℓ' 2027.8' N		ℓ' 569.6' S	
L1 54° - 37.9' S	M1 3910.8	L1 51° - 36.2' N	M1 3608.6	L1 60° - 10.3' N	M1 4528.0
L2 49° - 34.7' N	M2 3417.7	L2 61° - 13.2' S	M2 4656.3	L2 44° - 58.8' N	M2 3012.0
ℓ° 104° - 12.6' N	m 7328.6	ℓ° 112° - 49.5' S	m 8265.0	ℓ° 15° - 11.6' S	m 1516.1
ℓ' 6252.6' N		ℓ' 6769.5' S		ℓ' 911.6' S	

1 S 58.2° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

16 S 29.0° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

2 N 80.1° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

17 S 30.1° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

3 S 19.2° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

18 S 124.8° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

4 N 63.5° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

19 S 116.3° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

5 S 38.5° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

20 S 122.0° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

6 S 30.8° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

21 N 131.8° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

7 N 63.4° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

22 S 172.9° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

8 S 52.1° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

23 S 27.5° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

9 N 54.4° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

24 N 5.7° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

10 S 68.8° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

25 N 27.4° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

11 N 46.4° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

26 N 62.1° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

12 N 30.8° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

27 N 163.2° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

13 S 80.1° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

28 N 168.6° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

14 S 7.1° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

29 S 73.0° W \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

15 N 8.4° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

30 N 53.9° E \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

1 W 27.7° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

14 W 10.4° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

2 W 7.4° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

15 E 26.4° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

3 W 16.4° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

16 E 21.4° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

4 W 23.7° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

17 W 6.7° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

5 E 28.6° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

18 E 14.1° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

6 E 26.0° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

19 W 6.9° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

7 W 8.8° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

20 E 2.9° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

8 W 17.1° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

21 E 20.4° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

9 W 17.3° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

22 W 7.0° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

10 W 22.0° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

23 E 12.7° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

11 W 9.1° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

24 E 18.9° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

12 E 17.1° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

25 E 7.6° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

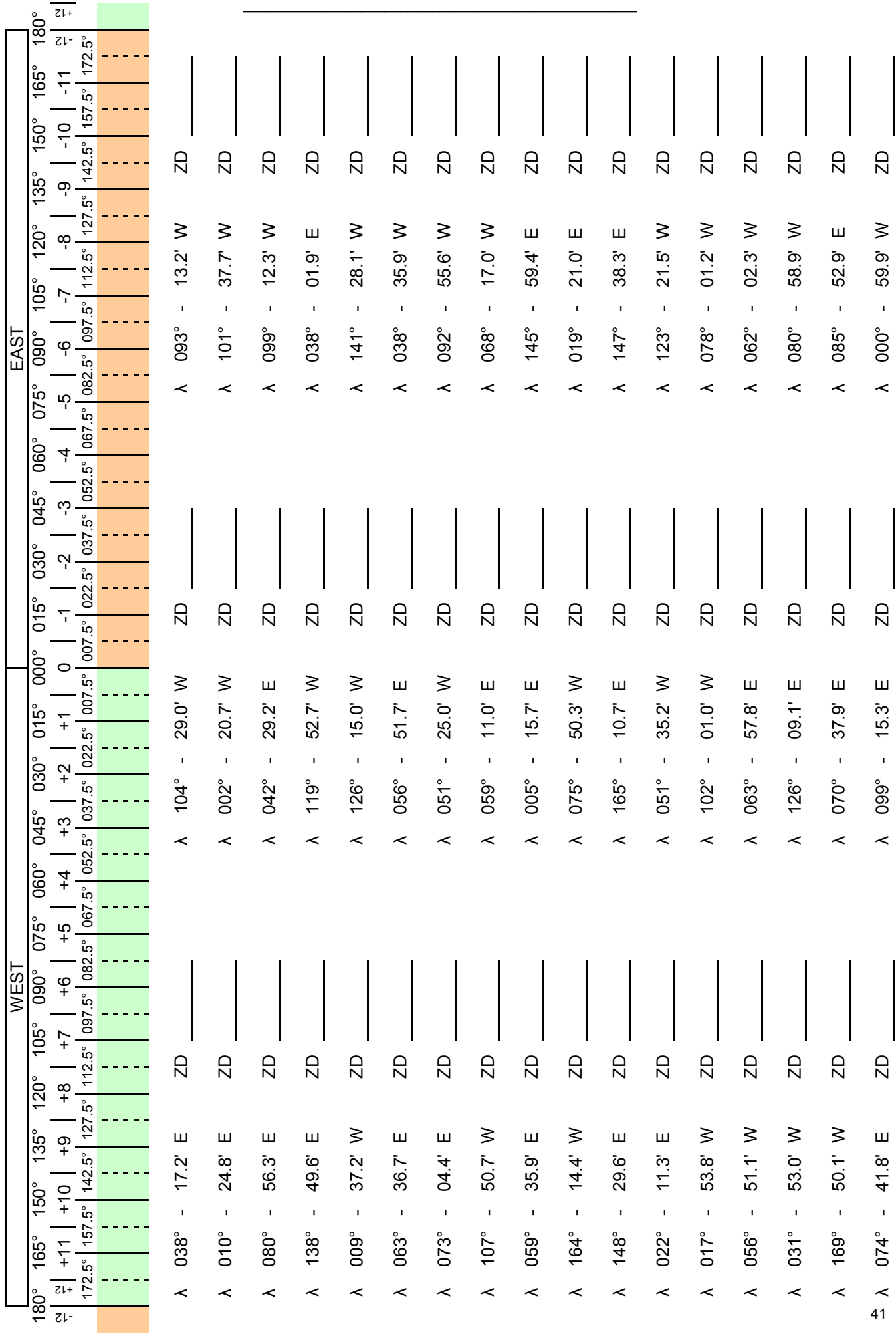
13 E 4.6° S \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

26 W 19.0° N \_\_\_\_\_ + / - \_\_\_\_\_ = \_\_\_\_\_

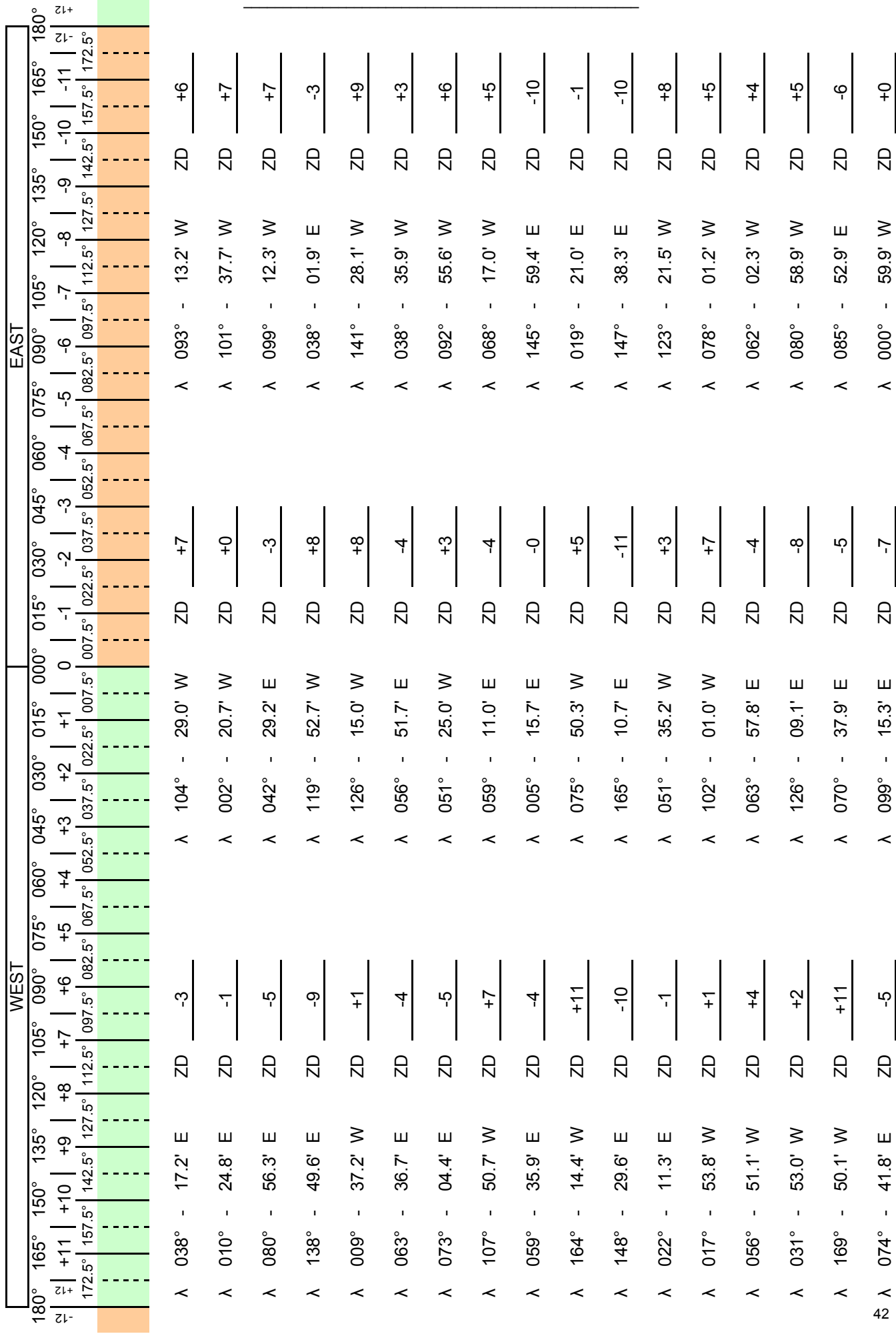
1 S 58.2° E	$180^\circ - 58.2^\circ = 121.8^\circ$	16 S 29.0° W	$180^\circ + 29.0^\circ = 209.0^\circ$
2 N 80.1° E	$000^\circ + 80.1^\circ = 080.1^\circ$	17 S 30.1° E	$180^\circ - 30.1^\circ = 149.9^\circ$
3 S 19.2° W	$180^\circ + 19.2^\circ = 199.2^\circ$	18 S 124.8° E	$180^\circ - 124.8^\circ = 055.2^\circ$
4 N 63.5° W	$360^\circ - 63.5^\circ = 296.5^\circ$	19 S 116.3° W	$180^\circ + 116.3^\circ = 296.3^\circ$
5 S 38.5° W	$180^\circ + 38.5^\circ = 218.5^\circ$	20 S 122.0° E	$180^\circ - 122.0^\circ = 058.0^\circ$
6 S 30.8° E	$180^\circ - 30.8^\circ = 149.2^\circ$	21 N 131.8° E	$000^\circ + 131.8^\circ = 131.8^\circ$
7 N 63.4° W	$360^\circ - 63.4^\circ = 296.6^\circ$	22 S 172.9° E	$180^\circ - 172.9^\circ = 007.1^\circ$
8 S 52.1° E	$180^\circ - 52.1^\circ = 127.9^\circ$	23 S 27.5° W	$180^\circ + 27.5^\circ = 207.5^\circ$
9 N 54.4° W	$360^\circ - 54.4^\circ = 305.6^\circ$	24 N 5.7° W	$360^\circ - 5.7^\circ = 354.3^\circ$
10 S 68.8° W	$180^\circ + 68.8^\circ = 248.8^\circ$	25 N 27.4° E	$000^\circ + 27.4^\circ = 027.4^\circ$
11 N 46.4° E	$000^\circ + 46.4^\circ = 046.4^\circ$	26 N 62.1° E	$000^\circ + 62.1^\circ = 062.1^\circ$
12 N 30.8° W	$360^\circ - 30.8^\circ = 329.2^\circ$	27 N 163.2° E	$000^\circ + 163.2^\circ = 163.2^\circ$
13 S 80.1° E	$180^\circ - 80.1^\circ = 099.9^\circ$	28 N 168.6° E	$000^\circ + 168.6^\circ = 168.6^\circ$
14 S 7.1° W	$180^\circ + 7.1^\circ = 187.1^\circ$	29 S 73.0° W	$180^\circ + 73.0^\circ = 253.0^\circ$
15 N 8.4° E	$000^\circ + 8.4^\circ = 008.4^\circ$	30 N 53.9° E	$000^\circ + 53.9^\circ = 053.9^\circ$
1 W 27.7° N	$270^\circ + 27.7^\circ = 297.7^\circ$	14 W 10.4° S	$270^\circ - 10.4^\circ = 259.6^\circ$
2 W 7.4° N	$270^\circ + 7.4^\circ = 277.4^\circ$	15 E 26.4° S	$090^\circ + 26.4^\circ = 116.4^\circ$
3 W 16.4° N	$270^\circ + 16.4^\circ = 286.4^\circ$	16 E 21.4° N	$090^\circ - 21.4^\circ = 068.6^\circ$
4 W 23.7° S	$270^\circ - 23.7^\circ = 246.3^\circ$	17 W 6.7° S	$270^\circ - 6.7^\circ = 263.3^\circ$
5 E 28.6° N	$090^\circ - 28.6^\circ = 061.4^\circ$	18 E 14.1° S	$090^\circ + 14.1^\circ = 104.1^\circ$
6 E 26.0° N	$090^\circ - 26.0^\circ = 064.0^\circ$	19 W 6.9° N	$270^\circ + 6.9^\circ = 276.9^\circ$
7 W 8.8° N	$270^\circ + 8.8^\circ = 278.8^\circ$	20 E 2.9° S	$090^\circ + 2.9^\circ = 092.9^\circ$
8 W 17.1° S	$270^\circ - 17.1^\circ = 252.9^\circ$	21 E 20.4° S	$090^\circ + 20.4^\circ = 110.4^\circ$
9 W 17.3° N	$270^\circ + 17.3^\circ = 287.3^\circ$	22 W 7.0° S	$270^\circ - 7.0^\circ = 263.0^\circ$
10 W 22.0° N	$270^\circ + 22.0^\circ = 292.0^\circ$	23 E 12.7° S	$090^\circ + 12.7^\circ = 102.7^\circ$
11 W 9.1° S	$270^\circ - 9.1^\circ = 260.9^\circ$	24 E 18.9° S	$090^\circ + 18.9^\circ = 108.9^\circ$
12 E 17.1° S	$090^\circ + 17.1^\circ = 107.1^\circ$	25 E 7.6° S	$090^\circ + 7.6^\circ = 097.6^\circ$
13 E 4.6° S	$090^\circ + 4.6^\circ = 094.6^\circ$	26 W 19.0° N	$270^\circ + 19.0^\circ = 289.0^\circ$



Find the ZD for the given Longitude by visually inspecting the Zone Time drawing.



Find the ZD for the given Longitude by visually inspecting the Zone Time drawing.



Find the LHA by adding together the GHA h and the m & s to the find the GHA and then applying the Longitude.

$$\begin{array}{l} \text{GHA h} \quad 176^\circ - 14.5' \\ \text{m \& s} \quad \underline{6^\circ - 34.5'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{048^\circ - 13.4' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 16^\circ - 41.1' \\ \text{m \& s} \quad \underline{6^\circ - 50.4'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{161^\circ - 14.0' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 314^\circ - 42.4' \\ \text{m \& s} \quad \underline{1^\circ - 35.3'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{120^\circ - 52.4' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 350^\circ - 19.2' \\ \text{m \& s} \quad \underline{11^\circ - 44.1'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{102^\circ - 16.5' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 118^\circ - 53.9' \\ \text{m \& s} \quad \underline{6^\circ - 07.1'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{134^\circ - 41.7' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 246^\circ - 28.5' \\ \text{m \& s} \quad \underline{9^\circ - 00.0'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{083^\circ - 24.2' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 334^\circ - 32.2' \\ \text{m \& s} \quad \underline{3^\circ - 51.5'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{139^\circ - 39.8' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 60^\circ - 51.6' \\ \text{m \& s} \quad \underline{0^\circ - 18.0'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{122^\circ - 33.8' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 12^\circ - 27.3' \\ \text{m \& s} \quad \underline{5^\circ - 57.0'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{053^\circ - 09.2' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 259^\circ - 53.5' \\ \text{m \& s} \quad \underline{1^\circ - 46.7'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{152^\circ - 53.4' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 101^\circ - 32.4' \\ \text{m \& s} \quad \underline{3^\circ - 50.5'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{132^\circ - 49.4' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 306^\circ - 59.3' \\ \text{m \& s} \quad \underline{10^\circ - 49.0'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{074^\circ - 06.0' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 180^\circ - 15.3' \\ \text{m \& s} \quad \underline{10^\circ - 29.5'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{052^\circ - 46.1' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 281^\circ - 19.2' \\ \text{m \& s} \quad \underline{8^\circ - 49.7'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{164^\circ - 42.2' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 113^\circ - 46.9' \\ \text{m \& s} \quad \underline{4^\circ - 44.5'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{009^\circ - 55.2' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 152^\circ - 51.3' \\ \text{m \& s} \quad \underline{9^\circ - 37.1'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{081^\circ - 09.1' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 64^\circ - 05.0' \\ \text{m \& s} \quad \underline{3^\circ - 30.9'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{154^\circ - 47.8' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 272^\circ - 32.5' \\ \text{m \& s} \quad \underline{3^\circ - 38.6'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{078^\circ - 15.4' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 324^\circ - 50.4' \\ \text{m \& s} \quad \underline{11^\circ - 53.5'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{068^\circ - 29.2' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 251^\circ - 51.2' \\ \text{m \& s} \quad \underline{10^\circ - 23.2'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{162^\circ - 05.2' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 147^\circ - 54.2' \\ \text{m \& s} \quad \underline{14^\circ - 30.0'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{179^\circ - 05.8' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 172^\circ - 23.7' \\ \text{m \& s} \quad \underline{8^\circ - 42.7'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{118^\circ - 22.5' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 208^\circ - 20.8' \\ \text{m \& s} \quad \underline{8^\circ - 16.8'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{037^\circ - 17.7' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 78^\circ - 48.8' \\ \text{m \& s} \quad \underline{10^\circ - 35.0'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{130^\circ - 36.7' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 154^\circ - 15.0' \\ \text{m \& s} \quad \underline{10^\circ - 24.3'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{102^\circ - 40.8' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 161^\circ - 02.6' \\ \text{m \& s} \quad \underline{14^\circ - 06.9'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{127^\circ - 36.7' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 42^\circ - 46.2' \\ \text{m \& s} \quad \underline{7^\circ - 25.4'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{104^\circ - 51.3' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 59^\circ - 57.3' \\ \text{m \& s} \quad \underline{14^\circ - 01.3'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{146^\circ - 49.4' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 147^\circ - 07.4' \\ \text{m \& s} \quad \underline{12^\circ - 50.3'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{176^\circ - 12.9' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 307^\circ - 41.1' \\ \text{m \& s} \quad \underline{2^\circ - 26.1'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{107^\circ - 55.0' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 16^\circ - 13.7' \\ \text{m \& s} \quad \underline{1^\circ - 15.0'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{045^\circ - 16.6' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 348^\circ - 22.5' \\ \text{m \& s} \quad \underline{13^\circ - 31.3'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{136^\circ - 13.2' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 270^\circ - 34.0' \\ \text{m \& s} \quad \underline{11^\circ - 08.4'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{140^\circ - 50.0' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 152^\circ - 16.9' \\ \text{m \& s} \quad \underline{1^\circ - 34.7'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{163^\circ - 12.1' \text{ W}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 230^\circ - 38.1' \\ \text{m \& s} \quad \underline{12^\circ - 28.3'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{110^\circ - 04.0' \text{ E}} \\ \text{LHA} \end{array}$$

$$\begin{array}{l} \text{GHA h} \quad 16^\circ - 47.2' \\ \text{m \& s} \quad \underline{5^\circ - 11.4'} \\ \text{GHA} \\ \text{DR } \lambda \quad \underline{095^\circ - 06.9' \text{ E}} \\ \text{LHA} \end{array}$$

Find the LHA by adding together the GHA h and the m & s to the find the GHA and then applying the Longitude.

$$\begin{array}{r} \text{GHA h} \quad 176^\circ - 14.5' \\ \text{m \& s} \quad \underline{6^\circ - 34.5'} \\ \text{GHA} \quad \underline{182^\circ - 49.0'} \\ \text{DR } \lambda \quad \underline{048^\circ - 13.4' \text{ W}} \\ \text{LHA} \quad \underline{134^\circ - 35.6'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 16^\circ - 41.1' \\ \text{m \& s} \quad \underline{6^\circ - 50.4'} \\ \text{GHA} \quad \underline{23^\circ - 31.5'} \\ \text{DR } \lambda \quad \underline{161^\circ - 14.0' \text{ E}} \\ \text{LHA} \quad \underline{184^\circ - 45.5'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 314^\circ - 42.4' \\ \text{m \& s} \quad \underline{1^\circ - 35.3'} \\ \text{GHA} \quad \underline{316^\circ - 17.7'} \\ \text{DR } \lambda \quad \underline{120^\circ - 52.4' \text{ E}} \\ \text{LHA} \quad \underline{77^\circ - 10.1'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 350^\circ - 19.2' \\ \text{m \& s} \quad \underline{11^\circ - 44.1'} \\ \text{GHA} \quad \underline{2^\circ - 03.3'} \\ \text{DR } \lambda \quad \underline{102^\circ - 16.5' \text{ E}} \\ \text{LHA} \quad \underline{104^\circ - 19.8'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 118^\circ - 53.9' \\ \text{m \& s} \quad \underline{6^\circ - 07.1'} \\ \text{GHA} \quad \underline{125^\circ - 01.0'} \\ \text{DR } \lambda \quad \underline{134^\circ - 41.7' \text{ W}} \\ \text{LHA} \quad \underline{350^\circ - 19.3'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 246^\circ - 28.5' \\ \text{m \& s} \quad \underline{9^\circ - 00.0'} \\ \text{GHA} \quad \underline{255^\circ - 28.5'} \\ \text{DR } \lambda \quad \underline{083^\circ - 24.2' \text{ E}} \\ \text{LHA} \quad \underline{338^\circ - 52.7'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 334^\circ - 32.2' \\ \text{m \& s} \quad \underline{3^\circ - 51.5'} \\ \text{GHA} \quad \underline{338^\circ - 23.7'} \\ \text{DR } \lambda \quad \underline{139^\circ - 39.8' \text{ W}} \\ \text{LHA} \quad \underline{198^\circ - 43.9'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 60^\circ - 51.6' \\ \text{m \& s} \quad \underline{0^\circ - 18.0'} \\ \text{GHA} \quad \underline{61^\circ - 09.6'} \\ \text{DR } \lambda \quad \underline{122^\circ - 33.8' \text{ W}} \\ \text{LHA} \quad \underline{298^\circ - 35.8'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 12^\circ - 27.3' \\ \text{m \& s} \quad \underline{5^\circ - 57.0'} \\ \text{GHA} \quad \underline{18^\circ - 24.3'} \\ \text{DR } \lambda \quad \underline{053^\circ - 09.2' \text{ W}} \\ \text{LHA} \quad \underline{325^\circ - 15.1'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 259^\circ - 53.5' \\ \text{m \& s} \quad \underline{1^\circ - 46.7'} \\ \text{GHA} \quad \underline{261^\circ - 40.2'} \\ \text{DR } \lambda \quad \underline{152^\circ - 53.4' \text{ W}} \\ \text{LHA} \quad \underline{108^\circ - 46.8'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 101^\circ - 32.4' \\ \text{m \& s} \quad \underline{3^\circ - 50.5'} \\ \text{GHA} \quad \underline{105^\circ - 22.9'} \\ \text{DR } \lambda \quad \underline{132^\circ - 49.4' \text{ W}} \\ \text{LHA} \quad \underline{332^\circ - 33.5'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 306^\circ - 59.3' \\ \text{m \& s} \quad \underline{10^\circ - 49.0'} \\ \text{GHA} \quad \underline{317^\circ - 48.3'} \\ \text{DR } \lambda \quad \underline{074^\circ - 06.0' \text{ W}} \\ \text{LHA} \quad \underline{243^\circ - 42.3'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 180^\circ - 15.3' \\ \text{m \& s} \quad \underline{10^\circ - 29.5'} \\ \text{GHA} \quad \underline{190^\circ - 44.8'} \\ \text{DR } \lambda \quad \underline{052^\circ - 46.1' \text{ W}} \\ \text{LHA} \quad \underline{137^\circ - 58.7'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 281^\circ - 19.2' \\ \text{m \& s} \quad \underline{8^\circ - 49.7'} \\ \text{GHA} \quad \underline{290^\circ - 08.9'} \\ \text{DR } \lambda \quad \underline{164^\circ - 42.2' \text{ E}} \\ \text{LHA} \quad \underline{94^\circ - 51.1'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 113^\circ - 46.9' \\ \text{m \& s} \quad \underline{4^\circ - 44.5'} \\ \text{GHA} \quad \underline{118^\circ - 31.4'} \\ \text{DR } \lambda \quad \underline{009^\circ - 55.2' \text{ W}} \\ \text{LHA} \quad \underline{108^\circ - 36.2'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 152^\circ - 51.3' \\ \text{m \& s} \quad \underline{9^\circ - 37.1'} \\ \text{GHA} \quad \underline{162^\circ - 28.4'} \\ \text{DR } \lambda \quad \underline{081^\circ - 09.1' \text{ W}} \\ \text{LHA} \quad \underline{81^\circ - 19.3'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 64^\circ - 05.0' \\ \text{m \& s} \quad \underline{3^\circ - 30.9'} \\ \text{GHA} \quad \underline{67^\circ - 35.9'} \\ \text{DR } \lambda \quad \underline{154^\circ - 47.8' \text{ W}} \\ \text{LHA} \quad \underline{272^\circ - 48.1'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 272^\circ - 32.5' \\ \text{m \& s} \quad \underline{3^\circ - 38.6'} \\ \text{GHA} \quad \underline{276^\circ - 11.1'} \\ \text{DR } \lambda \quad \underline{078^\circ - 15.4' \text{ E}} \\ \text{LHA} \quad \underline{354^\circ - 26.5'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 324^\circ - 50.4' \\ \text{m \& s} \quad \underline{11^\circ - 53.5'} \\ \text{GHA} \quad \underline{336^\circ - 43.9'} \\ \text{DR } \lambda \quad \underline{068^\circ - 29.2' \text{ E}} \\ \text{LHA} \quad \underline{45^\circ - 13.1'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 251^\circ - 51.2' \\ \text{m \& s} \quad \underline{10^\circ - 23.2'} \\ \text{GHA} \quad \underline{262^\circ - 14.4'} \\ \text{DR } \lambda \quad \underline{162^\circ - 05.2' \text{ W}} \\ \text{LHA} \quad \underline{100^\circ - 09.2'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 147^\circ - 54.2' \\ \text{m \& s} \quad \underline{14^\circ - 30.0'} \\ \text{GHA} \quad \underline{162^\circ - 24.2'} \\ \text{DR } \lambda \quad \underline{179^\circ - 05.8' \text{ E}} \\ \text{LHA} \quad \underline{341^\circ - 30.0'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 172^\circ - 23.7' \\ \text{m \& s} \quad \underline{8^\circ - 42.7'} \\ \text{GHA} \quad \underline{181^\circ - 06.4'} \\ \text{DR } \lambda \quad \underline{118^\circ - 22.5' \text{ E}} \\ \text{LHA} \quad \underline{299^\circ - 28.9'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 208^\circ - 20.8' \\ \text{m \& s} \quad \underline{8^\circ - 16.8'} \\ \text{GHA} \quad \underline{216^\circ - 37.6'} \\ \text{DR } \lambda \quad \underline{037^\circ - 17.7' \text{ E}} \\ \text{LHA} \quad \underline{253^\circ - 55.3'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 78^\circ - 48.8' \\ \text{m \& s} \quad \underline{10^\circ - 35.0'} \\ \text{GHA} \quad \underline{89^\circ - 23.8'} \\ \text{DR } \lambda \quad \underline{130^\circ - 36.7' \text{ W}} \\ \text{LHA} \quad \underline{318^\circ - 47.1'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 154^\circ - 15.0' \\ \text{m \& s} \quad \underline{10^\circ - 24.3'} \\ \text{GHA} \quad \underline{164^\circ - 39.3'} \\ \text{DR } \lambda \quad \underline{102^\circ - 40.8' \text{ W}} \\ \text{LHA} \quad \underline{61^\circ - 58.5'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 161^\circ - 02.6' \\ \text{m \& s} \quad \underline{14^\circ - 06.9'} \\ \text{GHA} \quad \underline{175^\circ - 09.5'} \\ \text{DR } \lambda \quad \underline{127^\circ - 36.7' \text{ E}} \\ \text{LHA} \quad \underline{302^\circ - 46.2'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 42^\circ - 46.2' \\ \text{m \& s} \quad \underline{7^\circ - 25.4'} \\ \text{GHA} \quad \underline{50^\circ - 11.6'} \\ \text{DR } \lambda \quad \underline{104^\circ - 51.3' \text{ W}} \\ \text{LHA} \quad \underline{305^\circ - 20.3'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 59^\circ - 57.3' \\ \text{m \& s} \quad \underline{14^\circ - 01.3'} \\ \text{GHA} \quad \underline{73^\circ - 58.6'} \\ \text{DR } \lambda \quad \underline{146^\circ - 49.4' \text{ W}} \\ \text{LHA} \quad \underline{287^\circ - 09.2'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 147^\circ - 07.4' \\ \text{m \& s} \quad \underline{12^\circ - 50.3'} \\ \text{GHA} \quad \underline{159^\circ - 57.7'} \\ \text{DR } \lambda \quad \underline{176^\circ - 12.9' \text{ E}} \\ \text{LHA} \quad \underline{336^\circ - 10.6'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 307^\circ - 41.1' \\ \text{m \& s} \quad \underline{2^\circ - 26.1'} \\ \text{GHA} \quad \underline{310^\circ - 07.2'} \\ \text{DR } \lambda \quad \underline{107^\circ - 55.0' \text{ E}} \\ \text{LHA} \quad \underline{58^\circ - 02.2'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 16^\circ - 13.7' \\ \text{m \& s} \quad \underline{1^\circ - 15.0'} \\ \text{GHA} \quad \underline{17^\circ - 28.7'} \\ \text{DR } \lambda \quad \underline{045^\circ - 16.6' \text{ W}} \\ \text{LHA} \quad \underline{332^\circ - 12.1'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 348^\circ - 22.5' \\ \text{m \& s} \quad \underline{13^\circ - 31.3'} \\ \text{GHA} \quad \underline{1^\circ - 53.8'} \\ \text{DR } \lambda \quad \underline{136^\circ - 13.2' \text{ W}} \\ \text{LHA} \quad \underline{225^\circ - 40.6'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 270^\circ - 34.0' \\ \text{m \& s} \quad \underline{11^\circ - 08.4'} \\ \text{GHA} \quad \underline{281^\circ - 42.4'} \\ \text{DR } \lambda \quad \underline{140^\circ - 50.0' \text{ E}} \\ \text{LHA} \quad \underline{62^\circ - 32.4'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 152^\circ - 16.9' \\ \text{m \& s} \quad \underline{1^\circ - 34.7'} \\ \text{GHA} \quad \underline{153^\circ - 51.6'} \\ \text{DR } \lambda \quad \underline{163^\circ - 12.1' \text{ W}} \\ \text{LHA} \quad \underline{350^\circ - 39.5'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 230^\circ - 38.1' \\ \text{m \& s} \quad \underline{12^\circ - 28.3'} \\ \text{GHA} \quad \underline{243^\circ - 06.4'} \\ \text{DR } \lambda \quad \underline{110^\circ - 04.0' \text{ E}} \\ \text{LHA} \quad \underline{353^\circ - 10.4'} \end{array}$$

$$\begin{array}{r} \text{GHA h} \quad 16^\circ - 47.2' \\ \text{m \& s} \quad \underline{5^\circ - 11.4'} \\ \text{GHA} \quad \underline{21^\circ - 58.6'} \\ \text{DR } \lambda \quad \underline{095^\circ - 06.9' \text{ E}} \\ \text{LHA} \quad \underline{117^\circ - 05.5'} \end{array}$$



Find the GHA ☆ by adding together the GHA ∅ h, m & s and the SHA ☆.

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 261^\circ - 26.3' \\ \text{m \& s} \quad \quad 5^\circ - 30.2' \\ \text{SHA } \star \quad \quad 211^\circ - 39.2' \\ \hline \text{GHA } \star \quad \quad 118^\circ - 35.7' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 292^\circ - 23.2' \\ \text{m \& s} \quad \quad 10^\circ - 24.5' \\ \text{SHA } \star \quad \quad 352^\circ - 36.2' \\ \hline \text{GHA } \star \quad \quad 295^\circ - 23.9' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 0^\circ - 48.6' \\ \text{m \& s} \quad \quad 10^\circ - 18.6' \\ \text{SHA } \star \quad \quad 300^\circ - 13.3' \\ \hline \text{GHA } \star \quad \quad 311^\circ - 20.5' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 34^\circ - 15.4' \\ \text{m \& s} \quad \quad 14^\circ - 28.1' \\ \text{SHA } \star \quad \quad 57^\circ - 48.1' \\ \hline \text{GHA } \star \quad \quad 106^\circ - 31.6' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 109^\circ - 35.6' \\ \text{m \& s} \quad \quad 4^\circ - 49.5' \\ \text{SHA } \star \quad \quad 159^\circ - 24.8' \\ \hline \text{GHA } \star \quad \quad 273^\circ - 49.9' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 261^\circ - 43.3' \\ \text{m \& s} \quad \quad 10^\circ - 31.4' \\ \text{SHA } \star \quad \quad 155^\circ - 24.2' \\ \hline \text{GHA } \star \quad \quad 67^\circ - 38.9' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 54^\circ - 46.3' \\ \text{m \& s} \quad \quad 10^\circ - 39.7' \\ \text{SHA } \star \quad \quad 246^\circ - 59.2' \\ \hline \text{GHA } \star \quad \quad 312^\circ - 25.2' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 103^\circ - 01.1' \\ \text{m \& s} \quad \quad 4^\circ - 50.9' \\ \text{SHA } \star \quad \quad 247^\circ - 13.9' \\ \hline \text{GHA } \star \quad \quad 355^\circ - 05.9' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 195^\circ - 40.0' \\ \text{m \& s} \quad \quad 9^\circ - 56.8' \\ \text{SHA } \star \quad \quad 318^\circ - 56.9' \\ \hline \text{GHA } \star \quad \quad 164^\circ - 33.7' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 38^\circ - 54.6' \\ \text{m \& s} \quad \quad 13^\circ - 34.0' \\ \text{SHA } \star \quad \quad 71^\circ - 08.4' \\ \hline \text{GHA } \star \quad \quad 123^\circ - 37.0' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 76^\circ - 18.0' \\ \text{m \& s} \quad \quad 1^\circ - 50.9' \\ \text{SHA } \star \quad \quad 32^\circ - 55.4' \\ \hline \text{GHA } \star \quad \quad 111^\circ - 04.3' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 335^\circ - 58.6' \\ \text{m \& s} \quad \quad 8^\circ - 13.8' \\ \text{SHA } \star \quad \quad 57^\circ - 16.6' \\ \hline \text{GHA } \star \quad \quad 41^\circ - 29.0' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 230^\circ - 44.4' \\ \text{m \& s} \quad \quad 12^\circ - 38.5' \\ \text{SHA } \star \quad \quad 304^\circ - 28.2' \\ \hline \text{GHA } \star \quad \quad 187^\circ - 51.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 210^\circ - 50.0' \\ \text{m \& s} \quad \quad 2^\circ - 04.4' \\ \text{SHA } \star \quad \quad 293^\circ - 51.7' \\ \hline \text{GHA } \star \quad \quad 146^\circ - 46.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 17^\circ - 36.7' \\ \text{m \& s} \quad \quad 4^\circ - 58.7' \\ \text{SHA } \star \quad \quad 77^\circ - 54.3' \\ \hline \text{GHA } \star \quad \quad 100^\circ - 29.7' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 117^\circ - 20.5' \\ \text{m \& s} \quad \quad 1^\circ - 50.8' \\ \text{SHA } \star \quad \quad 299^\circ - 50.8' \\ \hline \text{GHA } \star \quad \quad 59^\circ - 02.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 336^\circ - 15.7' \\ \text{m \& s} \quad \quad 12^\circ - 50.4' \\ \text{SHA } \star \quad \quad 41^\circ - 47.3' \\ \hline \text{GHA } \star \quad \quad 30^\circ - 53.4' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 39^\circ - 36.7' \\ \text{m \& s} \quad \quad 13^\circ - 30.6' \\ \text{SHA } \star \quad \quad 249^\circ - 08.8' \\ \hline \text{GHA } \star \quad \quad 302^\circ - 16.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 228^\circ - 24.8' \\ \text{m \& s} \quad \quad 5^\circ - 24.0' \\ \text{SHA } \star \quad \quad 189^\circ - 42.4' \\ \hline \text{GHA } \star \quad \quad 63^\circ - 31.2' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 96^\circ - 37.3' \\ \text{m \& s} \quad \quad 11^\circ - 11.0' \\ \text{SHA } \star \quad \quad 344^\circ - 13.8' \\ \hline \text{GHA } \star \quad \quad 92^\circ - 02.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 224^\circ - 03.9' \\ \text{m \& s} \quad \quad 12^\circ - 37.5' \\ \text{SHA } \star \quad \quad 33^\circ - 59.6' \\ \hline \text{GHA } \star \quad \quad 270^\circ - 41.0' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 187^\circ - 36.0' \\ \text{m \& s} \quad \quad 9^\circ - 00.1' \\ \text{SHA } \star \quad \quad 113^\circ - 01.0' \\ \hline \text{GHA } \star \quad \quad 309^\circ - 37.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 310^\circ - 30.1' \\ \text{m \& s} \quad \quad 12^\circ - 39.8' \\ \text{SHA } \star \quad \quad 223^\circ - 47.0' \\ \hline \text{GHA } \star \quad \quad 186^\circ - 56.9' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 171^\circ - 43.8' \\ \text{m \& s} \quad \quad 3^\circ - 56.0' \\ \text{SHA } \star \quad \quad 107^\circ - 52.8' \\ \hline \text{GHA } \star \quad \quad 283^\circ - 32.6' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 113^\circ - 33.7' \\ \text{m \& s} \quad \quad 13^\circ - 02.2' \\ \text{SHA } \star \quad \quad 221^\circ - 49.6' \\ \hline \text{GHA } \star \quad \quad 348^\circ - 25.5' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 3^\circ - 45.8' \\ \text{m \& s} \quad \quad 14^\circ - 54.3' \\ \text{SHA } \star \quad \quad 356^\circ - 50.4' \\ \hline \text{GHA } \star \quad \quad 15^\circ - 30.5' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 46^\circ - 26.0' \\ \text{m \& s} \quad \quad 11^\circ - 08.8' \\ \text{SHA } \star \quad \quad 96^\circ - 08.3' \\ \hline \text{GHA } \star \quad \quad 153^\circ - 43.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 104^\circ - 08.7' \\ \text{m \& s} \quad \quad 0^\circ - 49.1' \\ \text{SHA } \star \quad \quad 273^\circ - 51.9' \\ \hline \text{GHA } \star \quad \quad 18^\circ - 49.7' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 81^\circ 0' 01.3' \\ \text{m \& s} \quad \quad 14^\circ - 35.5' \\ \text{SHA } \star \quad \quad 277^\circ - 54.4' \\ \hline \text{GHA } \star \quad \quad 13^\circ - 31.2' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 320^\circ - 34.2' \\ \text{m \& s} \quad \quad 13^\circ - 12.3' \\ \text{SHA } \star \quad \quad 14^\circ - 44.9' \\ \hline \text{GHA } \star \quad \quad 348^\circ - 31.4' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 213^\circ - 56.8' \\ \text{m \& s} \quad \quad 6^\circ - 08.1' \\ \text{SHA } \star \quad \quad 192^\circ - 04.2' \\ \hline \text{GHA } \star \quad \quad 52^\circ - 09.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 16^\circ - 15.1' \\ \text{m \& s} \quad \quad 6^\circ - 47.7' \\ \text{SHA } \star \quad \quad 190^\circ - 00.6' \\ \hline \text{GHA } \star \quad \quad 213^\circ - 03.4' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 133^\circ - 26.0' \\ \text{m \& s} \quad \quad 9^\circ - 31.7' \\ \text{SHA } \star \quad \quad 205^\circ - 09.6' \\ \hline \text{GHA } \star \quad \quad 348^\circ - 07.3' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 9^\circ - 31.0' \\ \text{m \& s} \quad \quad 10^\circ - 01.3' \\ \text{SHA } \star \quad \quad 84^\circ - 55.8' \\ \hline \text{GHA } \star \quad \quad 104^\circ - 28.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad \quad 21^\circ - 01.5' \\ \text{m \& s} \quad \quad 13^\circ - 20.9' \\ \text{SHA } \star \quad \quad 212^\circ - 23.7' \\ \hline \text{GHA } \star \quad \quad 246^\circ - 46.1' \end{array}$$

$$\begin{array}{r} \text{GHA } \emptyset \text{ h} \quad 356^\circ - 05.4' \\ \text{m \& s} \quad \quad 0^\circ - 55.1' \\ \text{SHA } \star \quad \quad 166^\circ - 02.0' \\ \hline \text{GHA } \star \quad \quad 163^\circ - 02.5' \end{array}$$

Find the results of the two step interpolation process.

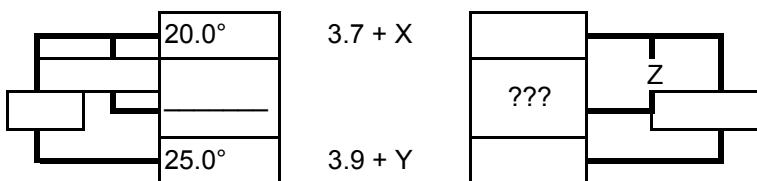
DR L 21° -15.5' S

Dec. N 3° -33.4'

	3.5°	3° 33.4'	4.0°
20.0°	3.7°	?	4.3°
25.0°	3.9°	?	4.0°

$\frac{Y}{25.0 - 20.0} = \frac{3.9 - 3.7}{4.3 - 3.7}$        $X = \frac{3.7 + (3.9 - 3.7) \cdot \frac{20.0 - 25.0}{25.0 - 20.0}}{4.3 - 3.7} = \frac{3.7 - 0.6}{0.6} = \frac{3.1}{0.6}$

$\frac{Y}{25.0 - 20.0} = \frac{3.9 - 3.7}{4.3 - 3.7}$        $Y = \frac{3.9 - 3.7}{4.3 - 3.7} \cdot (25.0 - 20.0) = \frac{0.2}{0.6} \cdot 5.0 = \frac{1.0}{0.3}$



$\frac{Z}{25.0 - 20.0} = \frac{3.9 + Y - 3.7 + X}{4.3 - 3.7}$

$Z = \frac{3.9 + Y - 3.7 + X}{4.3 - 3.7} \cdot (25.0 - 20.0)$

$???$

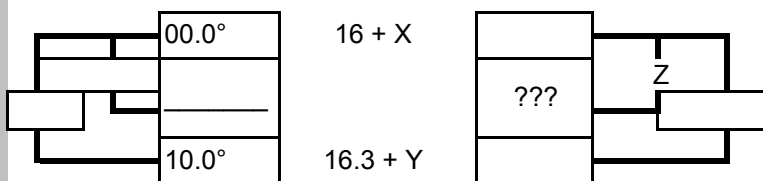
DR L 1° -29.7' N

Dec. S 16° -03.2'

	16.0°	16° 03.2'	16.5°
00.0°	16.0°	?	16.5°
10.0°	16.3°	?	16.8°

$\frac{X}{10.0 - 00.0} = \frac{16.3 - 16.0}{16.8 - 16.5}$        $X = \frac{16.0 + (16.3 - 16.0) \cdot \frac{00.0 - 10.0}{10.0 - 00.0}}{16.8 - 16.5} = \frac{16.0 - 0.3}{0.3} = \frac{15.7}{0.3}$

$\frac{X}{10.0 - 00.0} = \frac{16.3 - 16.0}{16.8 - 16.5}$        $Y = \frac{16.3 - 16.0}{16.8 - 16.5} \cdot (10.0 - 00.0) = \frac{0.3}{0.3} \cdot 10.0 = 10.0$



$\frac{Z}{10.0 - 00.0} = \frac{16.3 + Y - 16 + X}{16.8 - 16.5}$

$Z = \frac{16.3 + Y - 16 + X}{16.8 - 16.5} \cdot (10.0 - 00.0)$

$???$

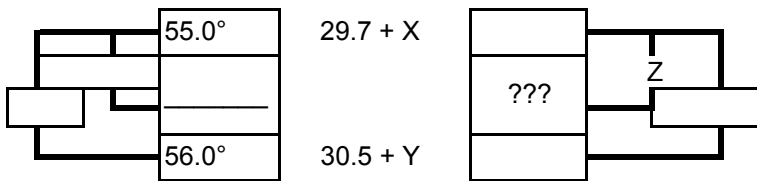
DR L 55° -59.9' N

Dec. N 16° -47.8'

	16.5°	16° 47.8'	17.0°
55.0°	29.7°	?	30.6°
56.0°	30.5°	?	17.0°

$\frac{Y}{56.0 - 55.0} = \frac{30.5 - 29.7}{17.0 - 30.6}$        $X = \frac{29.7 + (30.5 - 29.7) \cdot \frac{55.0 - 56.0}{56.0 - 55.0}}{17.0 - 30.6} = \frac{29.7 - 0.8}{-13.6} = \frac{28.9}{-13.6}$

$\frac{Y}{56.0 - 55.0} = \frac{30.5 - 29.7}{17.0 - 30.6}$        $Y = \frac{30.5 - 29.7}{17.0 - 30.6} \cdot (56.0 - 55.0) = \frac{0.8}{-13.6} \cdot 1.0 = \frac{-0.6}{13.6}$



$\frac{Z}{56.0 - 55.0} = \frac{30.5 + Y - 29.7 + X}{17.0 - 30.6}$

$Z = \frac{30.5 + Y - 29.7 + X}{17.0 - 30.6} \cdot (56.0 - 55.0)$

$???$

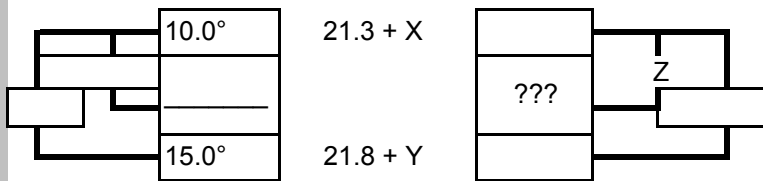
DR L 14° -09' S

Dec. N 21° -28'

	21.0°	21° 28.0'	21.5°
10.0°	21.3°	?	21.8°
15.0°	21.8°	?	22.3°

$\frac{X}{15.0 - 10.0} = \frac{21.8 - 21.3}{22.3 - 21.8}$        $X = \frac{21.3 + (21.8 - 21.3) \cdot \frac{10.0 - 15.0}{15.0 - 10.0}}{22.3 - 21.8} = \frac{21.3 - 0.5}{0.5} = \frac{20.8}{0.5}$

$\frac{X}{15.0 - 10.0} = \frac{21.8 - 21.3}{22.3 - 21.8}$        $Y = \frac{21.8 - 21.3}{22.3 - 21.8} \cdot (15.0 - 10.0) = \frac{0.5}{0.5} \cdot 5.0 = 5.0$



$\frac{Z}{15.0 - 10.0} = \frac{21.8 + Y - 21.3 + X}{22.3 - 21.8}$

$Z = \frac{21.8 + Y - 21.3 + X}{22.3 - 21.8} \cdot (15.0 - 10.0)$

$???$

Find the results of the two step interpolation process.

DR L 21° -15.5' S

Dec. N 3° -33.4'

	30		
	3.4		
	3.5°	3° 33.4'	4.0°
20.0°	3.7°	?	4.3°
	0.6		
21° -15.5'			
25.0°	3.9°	??	4.0°
	0.1		

$$\frac{X}{0.6} = \frac{3.4}{30} \quad X = \frac{3.4 \times 0.6}{30} = 0.1$$

$$\frac{Y}{0.1} = \frac{3.4}{30} \quad Y = \frac{3.4 \times 0.1}{30} = 0$$

5.0°	20.0°	3.7 + 0.1 =	3.8°	0.1
1° -15.5'	21° -15.5'	3.9 + 0 =	3.9°	Z

$$\frac{Z}{0.1} = \frac{1^\circ - 15.5'}{5.0^\circ} = \frac{1.3}{5}$$

$$Z = \frac{1.3 \times 0.1}{5} = 0$$

$$??? = 3.8 + 0 = 3.8^\circ$$

DR L 55° -59.9' N

Dec. N 16° -47.8'

	30		
	17.8		
	16.5°	16° 47.8'	17.0°
55.0°	29.7°	?	30.6°
	0.9		
55° -59.9'			
56.0°	30.5°	??	17.0°
	-13.5		

$$\frac{X}{0.9} = \frac{17.8}{30} \quad X = \frac{17.8 \times 0.9}{30} = 0.5$$

$$\frac{Y}{-13.5} = \frac{17.8}{30} \quad Y = \frac{17.8 \times -13.5}{30} = -8$$

1.0°	55.0°	29.7 + 0.5 =	30.2°	-7.7
0° -59.9'	55° -59.9'	30.5 + -8 =	22.5°	Z

$$\frac{Z}{-7.7} = \frac{0^\circ - 59.9'}{1.0^\circ} = \frac{1}{1}$$

$$Z = \frac{1 \times -7.7}{1} = -7.7$$

$$??? = 30.2 + -7.7 = 22.5^\circ$$

DR L 1° -29.7' N

Dec. S 16° -03.2'

	30		
	3.2		
	16.0°	16° 03.2'	16.5°
00.0°	16.0°	?	16.5°
	0.5		
1° -29.7'			
10.0°	16.3°	??	16.8°
	0.5		

$$\frac{X}{0.5} = \frac{3.2}{30} \quad X = \frac{3.2 \times 0.5}{30} = 0.1$$

$$\frac{Y}{0.5} = \frac{3.2}{30} \quad Y = \frac{3.2 \times 0.5}{30} = 0.1$$

10.0°	00.0°	16 + 0.1 =	16.1°	0.3
1° -29.7'	1° -29.7'	16.3 + 0.1 =	16.4°	Z

$$\frac{Z}{0.3} = \frac{1^\circ - 29.7'}{10.0^\circ} = \frac{1.5}{10}$$

$$Z = \frac{1.5 \times 0.3}{10} = 0$$

$$??? = 16.1 + 0 = 16.1^\circ$$

DR L 14° -09' S

Dec. N 21° -28'

	30		
	28.0		
	21.0°	21° 28.0'	21.5°
10.0°	21.3°	?	21.8°
	0.5		
14° -09'			
15.0°	21.8°	??	22.3°
	0.5		

$$\frac{X}{0.5} = \frac{28.0}{30} \quad X = \frac{28 \times 0.5}{30} = 0.5$$

$$\frac{Y}{0.5} = \frac{28.0}{30} \quad Y = \frac{28 \times 0.5}{30} = 0.5$$

5.0°	10.0°	21.3 + 0.5 =	21.8°	0.5
4° -09'	14° -09'	21.8 + 0.5 =	22.3°	Z

$$\frac{Z}{0.5} = \frac{4^\circ - 09'}{5.0^\circ} = \frac{4.2}{5}$$

$$Z = \frac{4.2 \times 0.5}{5} = 0.4$$

$$??? = 21.8 + 0.4 = 22.2^\circ$$