



LOSS PREVENTION

Tides



SHIPOWNERS

SECURITY FOR SMALL & SPECIALIST VESSELS



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The information and recommendations in this booklet are given in good faith and are meant to highlight best practices, good seamanship and common sense to reduce incidents that result in related claims. However, Members must take into consideration the guidance and regulatory requirements given by Flag states and other governing authorities when formulating policy in line with the contents of this publication.

NOT TO BE USED FOR NAVIGATION

Foreword

The Shipowners' Club provides P&I insurance for small and specialised vessels and, as such, the majority of our vessels trade in coastal waters. The fine technique of calculating tides is a very important aspect of voyage planning and is a crucial factor in determining whether passage through a particular waterway is safe or not.

Our analysis of the claims' causation has highlighted the fact that many grounding claims could have easily been avoided by simply following this basic technique.

The purpose of this booklet is to allow the seafarer to have a better understanding on how to perform the tidal calculations. We have included many solved examples as well as practice questions hoping that it will give a better understanding on the subject.

This booklet is one of three publications in a series and it is envisaged that together they will help eliminate some of the difficulties that befall those not so well versed in marine navigation.

We remain forever indebted to Captain H. Subramaniam for compiling this booklet series for us. Captain Subramaniam was a distinguished member of the nautical fraternity in a career spanning over 6 decades, including over 30 years of teaching experience. Apart from this series, he also authored eight textbooks on the operation of merchant ships which continue to be used by seafarers across the globe. It was his ability to put a subject across in a nutshell that made all his books easy to understand and helpful to those these are intended for.

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Chapter 1

► Tides: Theory and Definitions

What are Tides?

Tides are the rise and fall of sea levels caused by the gravitational forces of the moon and the sun.

Some Tidal Terms

High Water and Low Water

When the water level is at its highest, it is called High Water (HW) and when it is lowest, Low Water (LW).

Tidal range

The difference in level between HW and LW is called the range of tide or tidal range, expressed in metres.

Flooding and ebbing

When the water level is rising, it is called flood tide or flooding, and when decreasing, ebb tide or ebbing.

Tidal interval

The interval between HW and LW is usually between six and seven hours. Hence most coastal areas experience two HWs and two LWs per day.

Spring tides

During a full moon and new moon, the sun, moon, and the earth are in line. Hence the gravitational forces of the sun and moon complement each other and the tidal range is very high. This phenomenon is called spring tide (figure 1). Spring tides occur every two weeks.

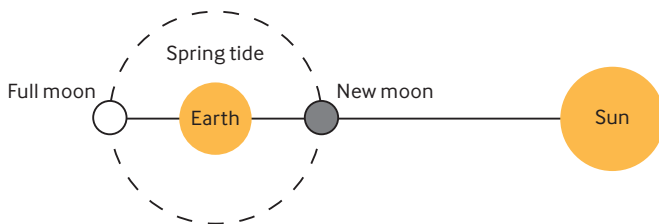


Figure 1

Neap tides

Midway between full moon and new moon, the moon and sun are 90° apart when seen from the earth. Their gravitational forces oppose each other and the tidal range is small. This phenomenon is called neap tide (figure 2). This occurs every two weeks.

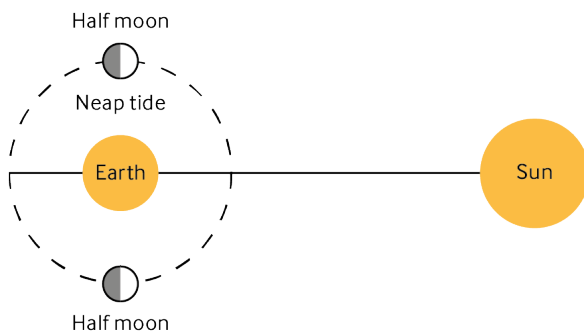


Figure 2

Tidal stream

A tidal stream is the direction and rate of movement of the sea surface due to the tide, wind and shape of adjoining coast.

Chart datum (CD)

CD is the water level at which all the depths shown on the charts would be correct. This is the lowest level of water expected in that area and is usually the level at LAT (Lowest Astronomical Tide) or MLWS (Mean Low Water Springs).

Tide tables would take this level as zero and any height of tide calculated would be above this chart datum. If at a particular location the charted depth is 5m, and the height of tide was calculated to be 1.2m, the actual depth of water at that location, at that time, would be 6.2m.

In rare cases, the tide can fall below chart datum. It is then given a minus sign. If at a particular location the charted depth is 4m, and the height of tide was calculated to be -0.3m, the actual depth of water at that location, at that time, would be 3.7m.

Semi-diurnal nature

Diurnal means daily. Since, in nearly all ports in the world, one cycle of tide (one HW and one LW) occurs every 12 hours or so, tides are termed semi-diurnal.

Mean spring range

This is the height difference between Mean Low Water Springs (MLWS) and Mean High Water Springs (MHWS).

Mean neap range

This is the height difference between Mean Low Water Neaps (MLWN) and Mean High Water Neaps (MHWN).

Tidal information

The times and heights of HW and LW for each day of the year are given in Port tide tables, Regional tide tables, and Admiralty tide tables (ATT).

Port tide tables

Many ports publish their own tide tables annually.

Regional tide tables

Regional hydrographic offices may publish tide tables for the ports listed therein, annually.

Chapter 2

► Tides: Calculation of Height of Tide at a Given Time

Admiralty tide tables are published annually in eight volumes:

Volume 1 – The UK and Ireland (including European Channel Ports)

Volume 2 – North Atlantic Ocean and Arctic Regions

Volume 3 – Indian Ocean (including tidal stream tables)

Volume 4 – South Pacific Ocean (including tidal stream tables)

Volume 5 – South China Sea and Indonesia (including tidal stream tables)

Volume 6 – North Pacific Ocean (including tidal stream tables)

Volume 7 – South West Atlantic Ocean and South America

Volume 8 – South East Atlantic Ocean, West Africa and Mediterranean (including tidal stream tables)

To make the ATT volumes less bulky, the ports are classed into standard ports and secondary ports.

Standard ports

Important ports in the area covered by each volume of ATT are designated as standard ports. The daily times and heights of HW and LW and details for calculating the times or heights in between are also provided.

Secondary ports

A large number of less important ports in the area covered by each volume of ATT are designated as secondary ports. Data for each secondary port is based on a standard port nearby such that the times and heights of HW and LW are obtained by applying a time and height difference to those at the standard port.

Such calculation is avoided by consulting the tide tables published by the port, or by the regional hydrographic office, wherein the daily times and heights of HW and LW are listed directly for each port.

To find height or time between tabulated values

The height of tide at a given time, or the time when a given height of tide occurs, can be obtained using tidal curves given in the ATT. The curves are of two types – port specific curves and general curves. Many standard ports in Europe have a page showing tidal curves for that specific port. For other ports, a set of general curves is provided.

Calculation using port-specific curves

Find the height of tide at Flushing in Europe at 1530 LT on 10 March of the year 20YY.

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 1: The UK and Ireland (including European Channel Ports).

Look at the Index to standard ports on the inside of the front cover (Appendix 1), locate Flushing, and open to that page (figure 3).

Step 2: Compute the bracketing range and tidal interval

Locate the bracketing tides on that day (figure 4). Required time: 1530 LT. Bracketing range = $4.4 - 0.3 = 4.1\text{m}$. Tidal interval = $1735 - 1146 = 5\text{h } 49\text{m}$.

Step 3: Draw sloping line near curves of the port

On the left side of the curves of that port locate the bracketed HW (4.3m) and LW (0.3m) heights and join them with a straight line as shown by a green line in figure 4.

Step 4: Draw vertical line at required time

Required time: 1530 LT. Bracketed HW time: 1735 LT. Time difference = 2h 5m before HW. Draw a vertical line at 2h 5m before HW to meet the curves, as shown by the red line in figure 4.

NETHERLANDS - VLISSINGEN (FLUSHING)

LAT 51°27'N LONG 3°36'E

TIME ZONE -0100

TIMES AND HEIGHTS OF HIGH AND LOW WATERS

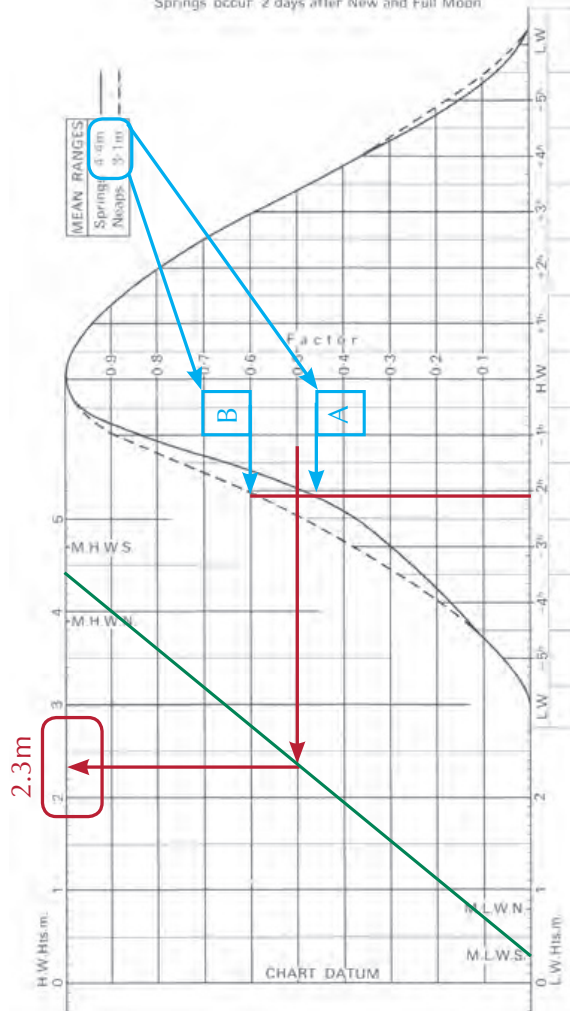
YEAR 1992

JANUARY			FEBRUARY			MARCH			APRIL			
Time	#	Time	Time	#	Time	Time	#	Time	Time	#	Time	
1 0538	4.0	16 0404	1 0946	0.0	1 0946	0.0	16 0020	4.4	1 0015	3.9	16 0605	4.4
1114	4.0	1030	0.0	1 0959	0.7	16 0218	4.4	1 0618	4.3	16 0828	0.3	
1408	0.8	1704	0.1	1 1310	4.2	16 0445	4.1	1 1032	0.5	16 1019	4.7	
		2408	4.2	1 1909	0.9	16 0644	0.8	1 1232	0.8	16 1226	0.3	
2 0600	4.1	17 0928	0.8	2 0125	4.5	17 0847	4.4	2 0108	4.1	17 0331	4.3	
0803	0.6	1111	4.9	2 0745	0.9	17 1016	0.3	2 0728	0.2	17 0906	0.2	
TH 1225	4.1	1 1735	0.8	2 1350	4.3	17 1312	4.7	2 1321	4.1	17 1282	4.7	
1445	0.8			1945	0.7	1695	0.4	1625	0.6	1622	0.3	
3 0955	4.8	18 0008	4.7	3 0205	4.8	18 0136	4.8	3 0128	4.3	18 0116	4.5	
0715	0.1	1030	0.8	3 0810	0.4	18 0808	0.0	3 0758	0.1	18 0749	4.5	
1320	4.3	SA 1235	4.4	M 1415	4.4	18 1386	4.8	4 1355	4.5	18 1335	4.8	
1425	0.8	1856	0.5	2020	0.1	2022	0.3	1956	0.6	2006	0.8	
4 0148	4.1	19 0102	4.5	4 0233	4.4	19 0218	4.8	4 0208	4.5	19 0156	4.8	
0755	0.8	0726	0.8	4 0849	0.1	19 0858	0.1	4 0825	0.2	19 0836	0.1	
SA 1354	4.3	1322	4.7	TU 1447	4.8	19 1436	5.0	4 1421	4.6	19 1416	4.7	
2008	0.8	1948	0.4	2056	0.8	2105	0.2	2020	0.5	2047	0.2	
5 0720	4.7	20 0148	4.7	5 0201	4.8	20 0238	4.8	5 0235	4.5	20 0236	4.8	
0929	0.1	0820	0.1	5 0925	0.8	20 0838	0.2	5 0939	0.8	20 0815	0.1	
SU 1430	4.4	14405	4.8	1517	4.8	1516	5.8	1448	4.7	1445	4.8	
2038	0.7	2036	0.3	2128	0.8	2146	0.2	2102	0.4	2128	0.3	
6 0952	4.8	21 0228	4.8	6 0331	4.8	21 0344	4.8	6 0302	4.5	21 0417	4.8	
M 1305	4.3	1455	0.0	6 1000	0.2	21 1010	0.2	6 1012	0.2	21 1045	4.8	
2110	0.1	2152	0.3	7 1549	4.7	1605	5.0	7 1517	4.7	1640	4.8	
				2259	0.8	2229	0.3	2136	0.6	2208	0.2	
7 0328	4.3	22 0318	4.8	7 0402	4.8	22 0428	4.8	7 0336	4.7	22 0358	4.8	
0940	0.1	0956	0.1	7 1032	0.2	22 1105	0.0	7 1005	0.2	22 1035	0.1	
TU 1539	4.6	1540	5.1	7 1618	4.5	22 1645	4.8	SA 1549	4.7	1623	4.7	
2145	0.7	2208	0.3	2238	0.8	2305	0.2	2230	0.8	2248	0.1	
8 0356	4.3	23 0408	4.8	8 0432	4.8	23 0508	4.8	8 0403	4.7	23 0443	4.7	
1019	4.8	1046	0.7	8 1106	0.6	23 1142	0.1	8 1038	0.2	23 1116	0.3	
M 1610	4.6	1626	0.0	SA 1649	4.8	23 1732	4.5	SU 1620	4.8	1705	4.4	
2225	0.7	2251	0.4	2306	0.8	2352	0.5	2239	0.8	2225	0.4	
9 0428	4.8	24 0450	4.8	9 0608	4.8	24 0688	4.8	9 0428	4.7	24 0526	4.8	
1056	0.1	1128	0.0	9 1138	0.6	24 1222	0.4	9 1111	0.3	24 1160	0.8	
TH 1645	4.6	F 1714	4.8	SU 1721	4.8	M 1625	4.2	M 1656	4.5	1740	4.8	
2255	0.1	2336	0.5	2335	0.8			2319	0.4			
10 0502	4.4	25 0533	4.8	10 0837	4.8	25 0936	4.8	10 0513	4.8	25 0606	4.8	
1130	0.1	1130	0.1	10 1212	0.7	25 0946	4.7	1148	0.1	25 0909	4.8	
F 1719	4.4	SA 1807	4.8	M 1758	4.4	25 1305	0.8	TU 1725	4.4	1820	4.7	
2325	0.3			1915	0.3			2346	0.8	1839	3.8	
11 0538	4.1	26 0619	4.8	11 0916	4.8	26 0124	0.8	11 0508	4.5	26 0555	4.8	
1134	0.4	0629	4.5	11 1817	4.9	26 0745	3.9	11 1248	0.2	26 0706	3.8	
SA 1756	4.4	TU 1850	0.8	TU 1850	0.8	26 1440	0.9	M 1852	4.2	TH 1830	3.0	
		1848	4.3	2014	0.5			1832	4.2	TH 1836	3.3	
12 0006	0.8	27 0110	0.7	12 0988	0.7	27 0255	1.8	12 0346	0.8	27 0215	0.8	
0616	0.8	0725	4.2	12 0716	4.1	27 0816	3.5	0640	4.2	27 0826	3.8	
SU 1235	0.5	M 1340	0.6	M 1345	0.6	TH 1624	1.1	TH 1330	0.6	F 1444	1.1	
1395	4.2	1355	4.0	2000	0.9	2406	3.4	1346	3.9	2094	3.3	
13 0945	4.8	28 0300	0.9	13 0930	0.9	28 0415	1.8	13 0346	0.8	28 0336	0.9	
0855	4.1	0855	3.9	13 0836	3.8	28 1046	3.8	13 0810	3.9	28 1036	3.9	
M 1325	0.6	TU 1456	0.9	TH 1506	0.9	13 1665	1.1	F 1440	0.8	SA 1034	3.1	
1355	4.0	2146	3.7	2125	0.8	2352	3.8	2469	4.1	2248	3.4	
14 0140	0.3	29 0330	1.0	14 0335	0.9	29 0335	0.8	14 0346	0.8	29 0450	0.8	
TU 1420	0.7	1019	0.8	F 1604	0.8	29 1151	3.7	F 1145	3.7	1121	3.7	
2061	4.0	0235	3.7	2240	1.8			TU 1818	0.5	W 1916	0.8	
15 0244	1.0	30 0930	3.9	15 0906	0.8			15 0509	4.3	30 0930	4.2	
0921	0.3	1110	2.4	15 1238	0.8			0946	0.1	30 0946	0.3	
W 1541	0.8	TH 1724	0.9	SA 1740	0.7			W 1239	4.6	TH 1639	4.4	
2200	3.9	2346	3.8	2358	4.3			1802	3.3	1856	0.5	
31 0610	0.8											
F 1830	0.9											

10 0513 4.6
TU 1146 0.3
1735 4.4
2356 0.5

Figure 3

Springs occur 2 days after New and Full Moon



8 | Tides

Step 5: Draw horizontal line

Note the points, marked as A and B in blue colour in figure 4, where the 2h 5m vertical red line meets the Mean Spring Range curve and the Mean Neap Range curve.

The firm curve is for mean spring range of	4.4m
The dotted curve is for mean neap range of	3.1m
Bracketed range from step 2	4.1m

Interpolate visually on the graph for 4.1m range between point A (for 4.4m range) and point B (for 3.1m range) and draw a horizontal line, as shown in red colour in figure 4, to meet the sloping green line.

From the point of intersection, draw a vertical line, as shown in red colour in figure 4, and obtain the height of tide above chart datum.

Step 6: State your answer

The height of tide at Flushing in Europe at 1530 LT on 10 March 20YY = **2.3m above chart datum.**

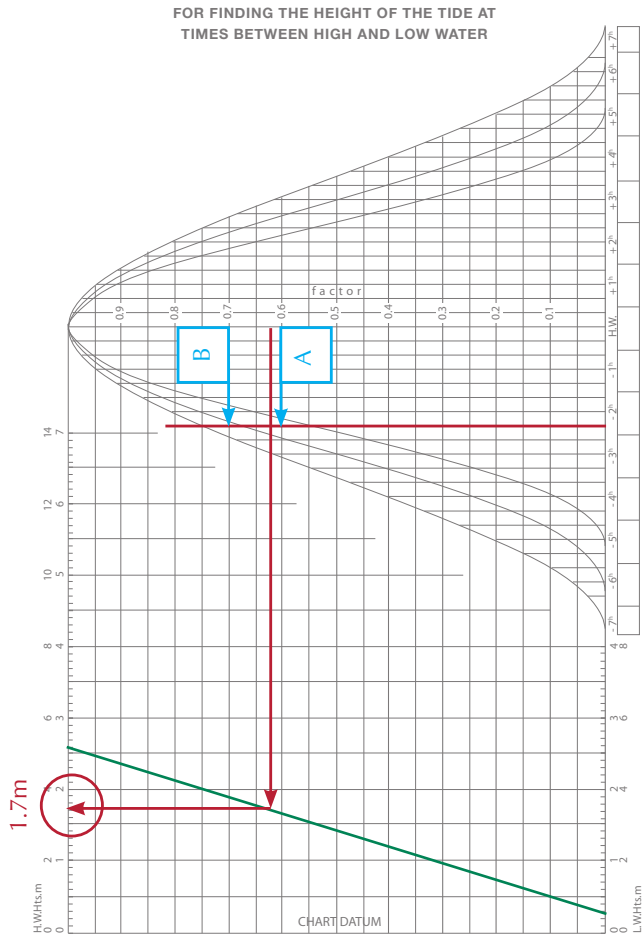


Figure 5

Calculation using general curves

Find height of tide at Singapore at 2300 LT on 6 April 20YY.

Step 1: Identify the appropriate ATT and open page of the given port

In this case, it is ATT for the year 20YY Volume 5: South China Sea and Indonesia (including tidal stream tables). Look at the index to standard ports on the inside of the front cover (Appendix 5), locate Singapore, and open to that page.

Note 1: The extracted values are given in step 2.

Note 2: There are no specific curves given for Singapore. You have to use a common set of curves given in the beginning of the tide tables which are suitable for tidal intervals between 5 hours and 7 hours. These are reproduced in Appendix 10.

Step 2: Compute the bracketing range and interval

Required time: 6 April 2300 LT. Bracketing tides are:

Date	Time (LT)	Height (m)
6 April	1916	0.3
7 April	0130	2.6

Bracketing range 2.3m and tidal interval 6h 14m.

Step 3: Draw sloping line near the curves

On the left side of the general curves locate the bracketed HW and LW heights and join them with a straight line shown by a green line in the graph, as shown in figure 5.

Step 4: Draw vertical line at required time

Required time: 6 April 2300 LT. Bracketed HW time: 7 April 0130 LT.

Time difference = 2h 30m before HW. Draw a vertical line at 2h 30m before HW to meet the curves, as shown by the red line in figure 5.

Step 5: Draw horizontal line

There are three curves: -5, -6 and -7 hours. Bracketing tidal interval is 6h 14m before HW.

Note the points A and B in figure 5 where the 2h30m vertical red line meets the 6h curve and the 7h curve.

Interpolate visually on the graph for 6h 14m between the points A and B and draw a horizontal line, as shown in figure 5, to meet the sloping green line.

From the point of intersection, draw a vertical line, as shown in red colour in figure 5, and obtain the height of tide.

Step 6: State your answer

Height of tide at Singapore at 2300 LT on 6 April 20YY = **1.7m above chart datum**.

Test yourself

Computing height of tide

Answers are given after each question. Worked solutions in detail are given on subsequent pages.

Question 1

Find height of tide at Dover (UK) at 1130 UT on 28 February of the year 20YY, using the extracts given below and the curve in Appendix 8:

Date	Time (UT)	Height (m)
28 February 20YY	0731	5.0
28 February 20YY	1437	2.3

Answer: 3.6m above chart datum.

Question 2

Find height of tide at Le Havre (France) at 0900 LT on 22 January 20YY, using the extracts given below and the curve in Appendix 9:

Date	Time (LT)	Height (m)
22 January 20YY	0726	0.9
22 January 20YY	1226	8.2

Answer: 5.0m above chart datum.

Question 3

Find height of tide at Tianjin Xingang (China) at 1400 LT on 17 April 20YY, using the extracts given below and the curves in Appendix 10:

Date	Time (LT)	Height (m)
17 April 20YY	1013	0.5
17 April 20YY	1606	4.0

Answer: 3.0m above chart datum.

Question 4

Find the height of tide at Cape Town (South Africa) at 1100 LT on 16 April 20YY using the extracts given below and the curves in Appendix 10:

Date	Time (LT)	Height (m)
16 April 20YY	0850	0.2
16 April 20YY	1458	1.8

Answer: 0.6m above chart datum.

Question 5

Find height of tide at Bhavnagar (India) at 0300 LT on 20 March 20YY using the extracts given below and the curves in Appendix 10:

Date	Time (LT)	Height (m)
20 March 20YY	0042	1.2
20 March 20YY	0548	10.4

Answer: 5.0m above chart datum.

Solutions on computing height of tide

Question 1

Find height of tide at Dover (UK) at 1130 UT on 28 February of the year 20YY, using the extracts given below and the curves in Appendix 8:

Date	Time (UT)	Height (m)
28 February 20YY	0731	5.0
28 February 20YY	1437	2.3

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 1: The UK and Ireland (including European Channel Ports).

Look at the Index to Standard Ports on the inside of the front cover (see Appendix 1), locate Dover (UK), and open to that page.

Step 2: Compute the bracketing range and tidal interval

Required time: 1130 UT. Bracketing tides:

Date	Time (UT)	Height (m)
28 February 20YY	0731	5.0
28 February 20YY	1437	2.3

Bracketing range = $5.0 - 2.3 = 2.7\text{m}$. Bracketing tidal interval = $1437 - 0731 = 07\text{h } 06\text{m}$.

Step 3: Draw sloping line near the curves of the port

On the left side of the curves of that port locate the bracketed HW (5.0m) and LW (2.3m) heights and join them with a straight line as shown by a green line in figure 6.

Step 4: Draw vertical line at required time

Required time: 1130 UT. Bracketed HW time: 0731 UT. Time difference = 3h 59m after HW. Draw a vertical line at 3h 59m after HW to meet the curves, as shown by the red line in figure 6.

Step 5: Draw horizontal line

Important Note: The point where the 3h 59m vertical red line meets the tidal curve. In this case the Mean Spring Range curve and the mean Neap Range curve are the same. From this point, draw a horizontal line, as shown in red colour in figure 6, to meet the sloping green line.

From the point of intersection, draw a vertical line, as shown in red colour in figure 6, and obtain the height of tide above chart datum.

Step 6: State your answer

The height of tide at Dover (UK) at 1130 UT on 28 Feb 20YY = **3.4m above chart datum**.



Question 2

Find the height of the tide at Le Havre (France) at 0900 LT on 22 January 20YY, using the extracts given below and the curves in Appendix 9:

Date	Time (LT)	Height (m)
22 January 20YY	0726	0.9
22 January 20YY	1226	8.2

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 2: North Atlantic Ocean and Arctic Regions, Mediterranean Sea and Atlantic Ocean. Look at the Index to Standard ports on the inside of the front cover (Appendix 2), locate Le Havre, and open to that page.

Step 2: Compute the bracketing range and tidal interval

Required time: 0900. Bracketing tides:

Date	Time (LT)	Height (m)
22 January 20YY	0726	0.9
22 January 20YY	1226	8.2

Bracketing range = $8.2 - 0.9 = 7.3\text{m}$. Tidal interval = $1226 - 0726 = 5\text{h } 00\text{m}$.

Step 3: Draw sloping line on curves of the port

On the left side of the curves of that port locate the bracketed HW (8.2m) and LW (0.9m) heights and join them with a straight line as shown by a green line in figure 7.

Step 4: Draw vertical line at required time

Required time: 0900 LT. Bracketed HW time: 1226 LT.

Time difference = 3h 26m before HW. Draw a vertical line at 3h 26m before HW to meet the curves, as shown by the red line in figure 7.

Step 5: Draw horizontal line

The firm curve is for mean spring range of	6.7m
The dotted curve is for mean neap range of	3.6m
Bracketed range from step 2	7.3m

Note: Bracketed range is 7.3m which is more than the mean spring range of 6.7m

Extrapolation is not allowed. Hence use only the mean spring curve in this case.

From the point where the 3h 26m vertical red line meets the mean spring range curve of 6.7m, draw a horizontal line, as shown in red colour to meet the sloping green range as shown in figure 7.

From the point of intersection, draw a vertical line, as shown in red colour in the graph, and obtain the height of tide.

Step 6: State your answer

The height of tide at Le Havre (France) at 0900 LT on 22 January in the year 20YY

= **5.0m above chart datum.**



Question 3

Find height of tide at Tianjin Xingang (China) at 1400 LT on 17 April 20YY, using the extracts given below and the curves in Appendix 10:

Date	Time (LT)	Height (m)
17 April 20YY	1013	0.5
17 April 20YY	1606	4.0

Step 1: Identify the appropriate ATT and open to the page of given port.

In this case, it is ATT for the year 20YY Volume 6: North Pacific Ocean (including tidal stream tables). Look at the index to standard ports on the inside of the front cover (Appendix 6), locate Tianjin Xingang, and open to that page.

Note: There are no specific curves given for Tianjin Xingang. You have to use a common set of curves given in the beginning of the tide tables which are suitable for tidal intervals between 5 hours and 7 hours.

Step 2: Compute the bracketing range and interval

Required time: 17 April, 1400 LT. Bracketing tides:

Date	Time (LT)	Height (m)
17 April 20YY	1013	0.5
17 April 20YY	1606	4.0

Bracketing range 3.5m and tidal interval 5h 53m.

Step 3: Draw sloping line on curves

On the left side of the general curves locate the bracketed HW and LW heights and join them with a straight line as shown by a green line in figure 8.

Step 4: Draw vertical line at required time

Required time: 17 April 20YY, 1400 LT. Bracketed HW time: 1606 LT.

Time difference = 2h 06m before HW. Draw a vertical line at 2h 06 before HW to meet the curves, as shown by the red line in figure 8.

Step 5: Draw horizontal line

There are three curves: -5, -6 and -7 hours. Bracketing tidal interval is 5h 53m.

Note the points where the 2h 06m vertical red line meets the 5h curve and the 6h curve.

Interpolate visually on the graph for 5h 53m between the 5h and 6h curves and draw a horizontal line, as shown in figure 8, to meet the sloping green line.

From the point of intersection, draw a vertical line, as shown in red colour in figure 8, and obtain the height of tide.

Step 6: State your answer

Height of tide at Tianjin Xingang (China) at 1400 LT on 17 April 20YY = **3.0m above chart datum**.

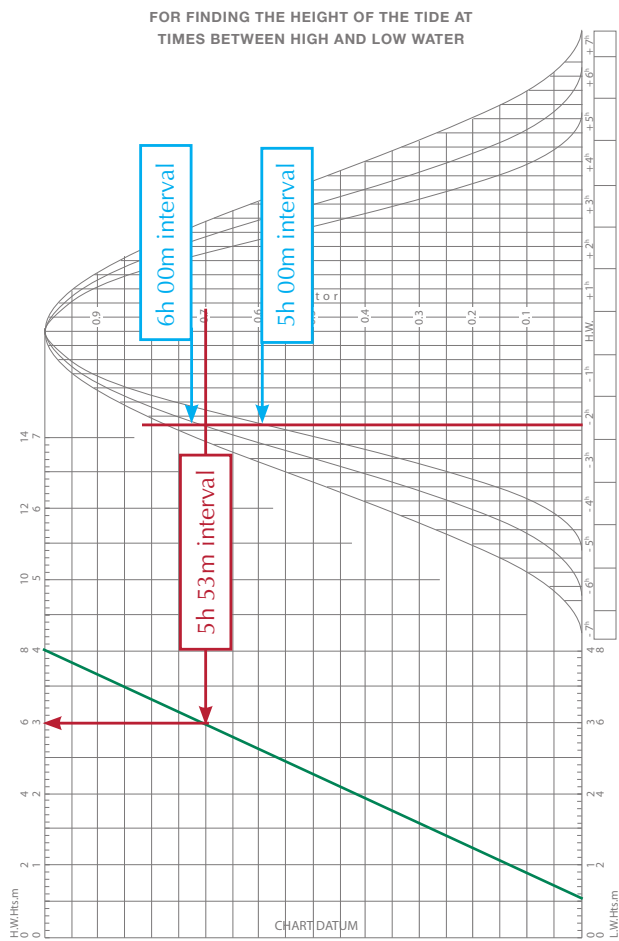


Figure 8

Question 4

Find the height of tide at Cape Town (South Africa) at 1100 LT on 16 April 20YY using the following extracts and the curves in Appendix 10:

Date	Time (LT)	Height (m)
16 April 20YY	0850	0.2
16 April 20YY	1458	1.8

Important note: There are no specific curves given for Cape Town. You have to use a common set of curves given in the beginning of the tide tables which are suitable for tidal intervals between 5 hours and 7 hours.

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 8: South East Atlantic Ocean, West Africa and Mediterranean (including tidal stream tables).

Look at the index to standard ports on the inside of the front cover (Appendix 7), locate Cape Town (South Africa), and open to that page.

Step 2: Compute the bracketing range and interval

Required time: 16 April 1100 LT. Bracketing tides:

Date	Time (LT)	Height (m)
16 April 20YY	0850	0.2
16 April 20YY	1458	1.8

Bracketing range 1.6m and tidal interval 6h 08m.

Step 3: Draw sloping line on curves

On the left side of the general curves locate the bracketed HW and LW heights and join them with a straight line as shown by a green line in figure 9.

Step 4: Draw vertical line at required time

Required time: 1100 LT. Bracketed HW time: 1458 LT.

Time difference = 3h 58m before HW. Draw a vertical line at 3h 58m before HW to meet the curves, as shown by the red line in figure 9.

Step 5: Draw horizontal line

There are three curves: -5, -6 and -7 hours. Bracketing tidal interval is 6h 8m before HW. Note the points where the 3h 58m vertical red line meets the 6h curve and the 7h curve.

Interpolate visually on the graph for 6h 8m between the 6h and 7h curves and draw a horizontal line, as shown in red colour in figure 9, to meet the sloping green line.

From the point of intersection, draw a vertical line, as shown in red colour in figure 9, and obtain the height of tide.

Step 6: State your answer

The height of tide at Cape Town (South Africa) at 1100 LT on 16 Apr 20YY = **0.6m above chart datum**.

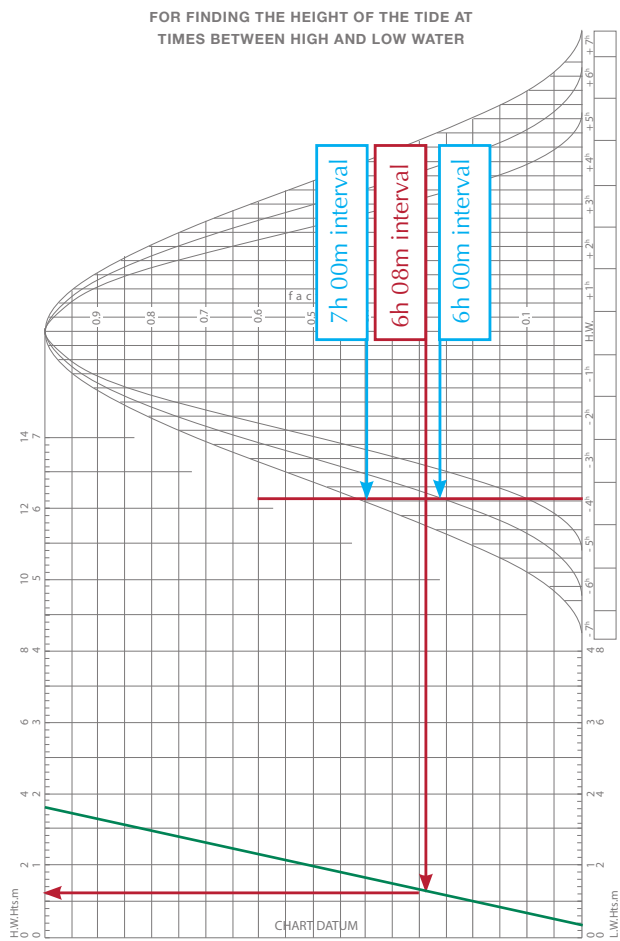


Figure 9

Question 5

Find height of tide at Bhavnagar (India) at 0300 LT on 20 March 20YY using the extracts given below and the curves in Appendix 3:

Date	Time (LT)	Height (m)
20 March 20YY	0042	1.2
20 March 20YY	0548	10.4

Important note: There are no specific curves given for Bhavnagar. You have to use a common set of curves given in the beginning of the Tide Tables which are suitable for tidal intervals between 5 hours and 7 hours.

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 3: Indian Ocean (including Tidal stream tables). Look at the Index to Standard Ports on the inside of the front cover (Appendix 3), locate Bhavnagar, and open to that page.

Step 2: Compute the bracketing range and interval

Required time: 20 March, 0300 LT. Bracketing tides:

Date	Time (LT)	Height (m)
20 March 20YY	0042	1.2
20 March 20YY	0548	10.4

Bracketing range 9.2m and tidal interval 5h 06m.

Step 3: Draw sloping line on curves

On the left side of the general curves locate the bracketed HW and LW heights and join them with a straight line as shown by a green line in figure 10.

Step 4: Draw vertical line at required time

Required time: 0300 LT. Bracketed HW time: 0548 LT. Time difference = 2h 48m before HW. Draw a vertical line at 2h 48m before HW to meet the curves, as shown by the red line in figure 10.

Step 5: Draw horizontal line

There are three curves: -5, -6 and -7 hours. Bracketing tidal interval is 2h 48m before HW. Note the points where the 2h 48m vertical red line meets the 5h curve and the 6h curve.

Interpolate visually on the graph for 5h 6m between the 5h and 6h curves and draw a horizontal line, as shown in figure 10, to meet the sloping green line.

From the point of intersection, draw a vertical line, as shown in red colour in figure 10, and obtain the height of tide.

Step 6: State your answer

Height of tide at Bhavnagar (India) at 0300 LT on 20 March 20YY = **5.0m above chart datum**.

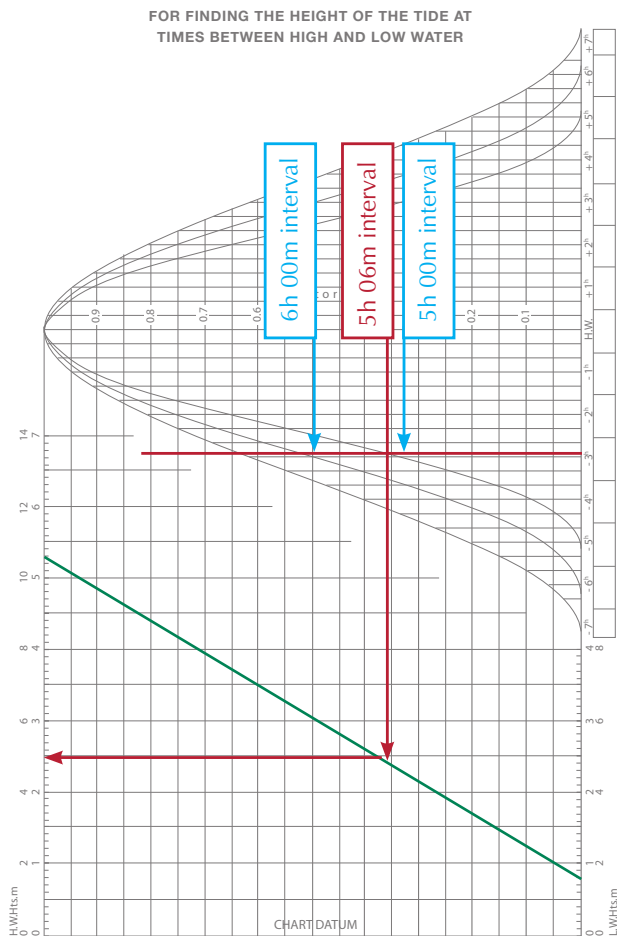


Figure 10

Depth of water = Charted depth + height of tide above CD

Depth of water = Draft of ship + under keel clearance

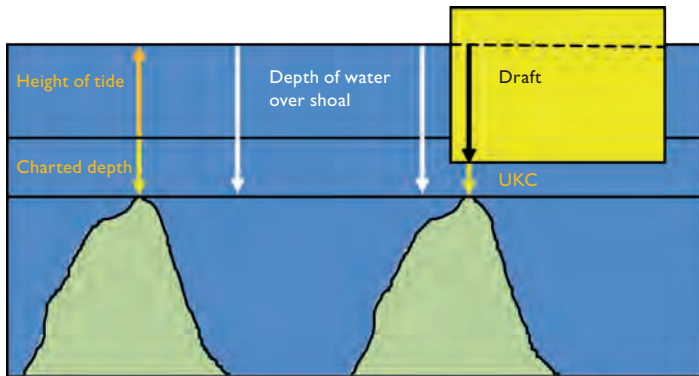


Figure 11

Calculation using port-specific curves

Find the earliest time on the afternoon of 9 January 20YY, at Flushing in Europe, when your ship with 5.5m draft aft can cross a bar marked 3.0m on the chart with UKC (Under Keel Clearance) of 1.0m.

If your ship is delayed by a couple of hours, how late can you cross the bar?

Note: 'Earliest time' indicates rising tide - there is insufficient height of tide 15 minutes earlier but it has now risen to level needed. Similarly, 'latest time' would indicate falling tide.

Chapter 3

► Tides: Calculation of Time for a Given Height of Tide

Preliminary calculation

DRAFT	5.5m
UKC	1.0m
Required depth	6.5m
Charted depth	3.0m
Required height of tide	3.5m

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 1: The UK and Ireland (including European Channel Ports). Look at the index to standard ports on the inside of the front cover (Appendix 1), locate Flushing, and open to that page (figure 12).

NETHERLANDS - VLISSINGEN (FLUSHING)											
LAT 52°27'N LONG 3°36'E											
TIME ZONE -0100											
TIME AND HEIGHTS OF HIGH AND LOW WATERS											
FEBRUARY											
MARCH											
APRIL 1952											
TIME	DAY	TIME	DAY	TIME	DAY	TIME	DAY	TIME	DAY	TIME	DAY
1	1339	16	1607	1	1340	16	1607	1	1341	16	1608
1	1340	16	1608	1	1341	16	1609	1	1342	16	1610
1	1343	16	1611	1	1344	16	1612	1	1345	16	1613
2	1346	16	1614	2	1347	16	1615	2	1348	16	1616
2	1349	16	1618	2	1350	16	1621	2	1351	16	1624
3	1352	16	1621	3	1353	16	1624	3	1354	16	1627
3	1356	16	1628	3	1357	16	1631	3	1358	16	1634
4	1359	16	1635	4	1400	16	1642	4	1401	16	1645
4	1403	16	1652	4	1404	16	1655	4	1405	16	1658
5	1406	16	1700	5	1407	16	1703	5	1408	16	1706
5	1409	16	1708	5	1410	16	1711	5	1411	16	1714
6	1412	16	1716	6	1413	16	1719	6	1414	16	1722
6	1415	16	1724	6	1416	16	1727	6	1417	16	1730
7	1418	16	1732	7	1419	16	1735	7	1420	16	1738
7	1421	16	1740	7	1422	16	1743	7	1423	16	1746
8	1424	16	1748	8	1425	16	1751	8	1426	16	1754
8	1427	16	1756	8	1428	16	1800	8	1429	16	1803
9	1430	16	1804	9	1431	16	1807	9	1432	16	1810
9	1433	16	1812	9	1434	16	1815	9	1435	16	1818
10	1436	16	1820	10	1437	16	1823	10	1438	16	1826
10	1439	16	1828	10	1440	16	1831	10	1441	16	1834
11	1442	16	1836	11	1443	16	1839	11	1444	16	1842
11	1445	16	1844	11	1446	16	1847	11	1447	16	1850
12	1448	16	1852	12	1449	16	1855	12	1450	16	1858
12	1451	16	1900	12	1452	16	1903	12	1453	16	1906
13	1454	16	1908	13	1455	16	1911	13	1456	16	1914
13	1457	16	1916	13	1458	16	1919	13	1459	16	1922
14	1460	16	1924	14	1461	16	1927	14	1462	16	1930
14	1463	16	1932	14	1464	16	1935	14	1465	16	1938
15	1466	16	1940	15	1467	16	1943	15	1468	16	1946
15	1469	16	1948	15	1470	16	1951	15	1471	16	1954
16	1472	16	1956	16	1473	16	1959	16	1474	16	2002
16	1475	16	2000	16	1476	16	2003	16	1477	16	2006
17	1478	16	2008	17	1479	16	2011	17	1480	16	2014
17	1481	16	2016	17	1482	16	2019	17	1483	16	2022
18	1484	16	2024	18	1485	16	2027	18	1486	16	2030
18	1487	16	2032	18	1488	16	2035	18	1489	16	2038
19	1490	16	2040	19	1491	16	2043	19	1492	16	2046
19	1493	16	2048	19	1494	16	2051	19	1495	16	2054
20	1496	16	2056	20	1497	16	2059	20	1498	16	2102
20	1499	16	2100	20	1500	16	2103	20	1501	16	2106
21	1502	16	2108	21	1503	16	2111	21	1504	16	2114
21	1505	16	2116	21	1506	16	2119	21	1507	16	2122
22	1508	16	2124	22	1509	16	2127	22	1510	16	2130
22	1511	16	2132	22	1512	16	2135	22	1513	16	2138
23	1514	16	2140	23	1515	16	2143	23	1516	16	2146
23	1517	16	2148	23	1518	16	2151	23	1519	16	2154
24	1520	16	2156	24	1521	16	2159	24	1522	16	2202
24	1523	16	2200	24	1524	16	2203	24	1525	16	2206
25	1526	16	2208	25	1527	16	2211	25	1528	16	2214
25	1529	16	2216	25	1530	16	2219	25	1531	16	2222
26	1532	16	2224	26	1533	16	2227	26	1534	16	2230
26	1535	16	2232	26	1536	16	2235	26	1537	16	2238
27	1538	16	2240	27	1539	16	2243	27	1540	16	2246
27	1541	16	2248	27	1542	16	2251	27	1543	16	2254
28	1544	16	2256	28	1545	16	2259	28	1546	16	2302
28	1547	16	2300	28	1548	16	2303	28	1549	16	2306
29	1550	16	2308	29	1551	16	2311	29	1552	16	2314
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31	1605	16	2348	31	1606	16	2351	31	1607	16	2354
32	1608	16	2356	32	1609	16	2359	32	1610	16	2402
32	1611	16	2400	32	1612	16	2403	32	1613	16	2406
33	1614	16	2408	33	1615	16	2411	33	1616	16	2414
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34	1623	16	2432	34	1624	16	2435	34	1625	16	2438
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35	1629	16	2448	35	1630	16	2451	35	1631	16	2454
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36	1635	16	2500	36	1636	16	2503	36	1637	16	2506
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38	1644	16	2524	38	1645	16	2527	38	1646	16	2530
38	1647	16	2532	38	1648	16	2535	38	1649	16	2538
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40	1656	16	2556	40	1657	16	2559	40	1658	16	2602
40	1659	16	2600	40	1700	16	2603	40	1701	16	2606
41	1702	16	2608	41	1703	16	2611	41	1704	16	2614
41	1705	16	2616	41	1706	16	2619	41	1707	16	2622
42	1708	16	2624	42	1709	16	2627	42	1710	16	2630
42	1711	16	2632	42	1712	16	2635	42	1713	16	2638
43	1714	16	2640	43	1715	16	2643	43	1716	16	2646
43	1717	16	2648	43	1718	16	2651	43	1719	16	2654
44	1720	16	2656	44	1721	16	2659	44	1722	16	2702
44	1723	16	2700	44	1724	16	2703	44	1725	16	2706
45	1726	16	2708	45	1727	16	2711	45	1728	16	2714
45	1729	16	2716	45	1730	16	2719	45	1731	16	2722
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47	1741	16	2748	47	1742	16	2751	47	1743	16	2754
48	1744	16	2756	48	1745	16	2759	48	1746	16	2802
48	1747	16	2800	48	1748	16	2803	48	1749	16	2806
49	1750	16	2808	49	1751	16	2811	49	1752	16	2814
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52	1811	16	2900	52	1812	16	2903	52	1813	16	2906
53	1814	16	2908	53	1815	16	2911	53	1816	16	2914
53	1817	16	2916	53	1818	16	2919	53	1819	16	2922
54	1820	16	2924	5							

9

0428 4.5
1056 0.3
1245 4.5
2655 0.7

TH

Step 2: Compute the bracketing range and tidal interval

Locate the bracketing tides on that day (figure 12). Required: Afternoon, rising tide, height of 3.5m.

Date	Time (LT)	Height (m)
9 January 20YY	1056	0.3
9 January 20YY	1645	4.5

Bracketing tides: Range 4.2m; tidal interval 5h 49m.

Step 3: Draw sloping line on curves of the port

On the left side of the curves of that port locate the bracketed heights – HW 4.5m and LW 0.3m and join them with a straight line as shown by a green line in figure 13.

Step 4: Draw vertical and horizontal lines

Required height of tide: 3.5m. Draw a vertical line at 3.5m to meet the sloping green line. From the point of intersection, draw a horizontal line, as shown in red colour in figure 13, across the curves for rising tide.

Step 5: Draw vertical line at appropriate curve and compute time

The firm curve is for mean spring range of	4.4m
The dotted curve is for mean neap range of	3.1m
Bracketed range from step 2	4.2m

Note the points where the horizontal red line meets the mean spring range curve of 4.4m and the mean neap range curve of 3.1m as shown in blue colour in figure 13.

Interpolate visually in figure 13 for 4.2m range between the curves for 4.4m and 3.1m and draw a vertical line, as shown in red colour in figure 13. Read off the interval before HW and compute the required time which is 1h 20m before HW in this case. Required time = 1645 – 1h 20m = 1525 LT.

Step 6: State your answer

The earliest time on the afternoon of 9 January 20YY, at Flushing in Europe, when your ship drawing 5.5m at the after end can cross a bar marked 3.0m with UKC (Under Keel Clearance) of 1.5m is 1525 LT.

If your ship is delayed by a couple of hours:

Extend the horizontal line in step 4 to meet the falling tide. From the point of intersection, draw a vertical line, as shown by blue dotted lines in figure 13, and read off the time interval. In this case it is 02h 10m after HW. Latest time = 1645 + 2h 10m = 1855 LT.

Answer: If your ship is delayed by a couple of hours, you can still cross the bar up to **1855 LT**.

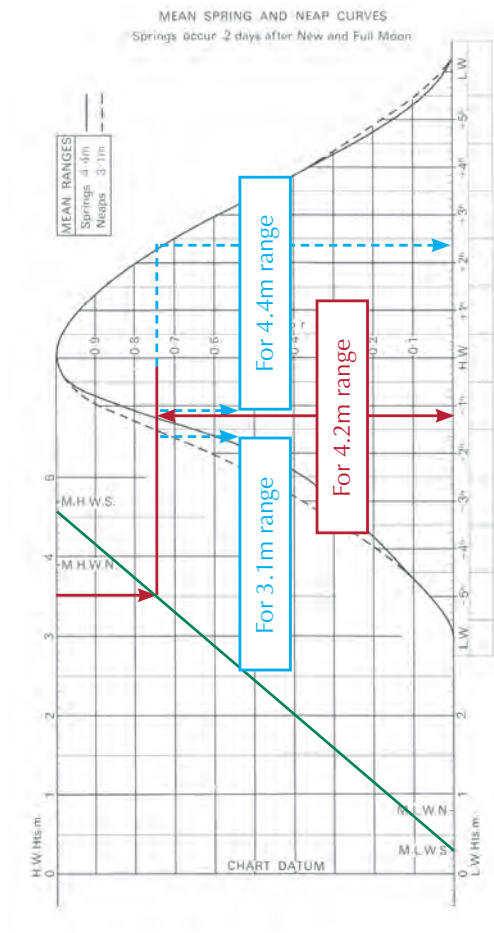


Figure 13

Calculation of time using general curves

Find the latest time on the afternoon of 19 January 20YY, at Boston (USA east coast), when your ship drawing 3.5m at the after end can cross a bar marked 2.0m on the chart with UKC (Under Keel Clearance) of 1.0m, using the following extracts and the curves given in appendix 7.

Date	Time	Height (m)
19 January 20YY	1009	3.6m
19 January 20YY	1636	-0.5m

Note: 'Latest time' indicates falling tide - there is sufficient height of tide at the calculated time, but after 15 minutes it is too shallow. So tide is falling. Similarly, 'earliest time' would indicate rising tide.

Preliminary calculation

DRAFT	3.5m
UKC	1.0m
Required depth	4.5m
Charted depth	2.0m
Required height of tide	2.5m

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 2: North Atlantic Ocean and Arctic Regions. Look at the index to standard ports on the inside of the front cover (Appendix 2), locate Boston, and open to that page. For convenience, the extract for that day is given in the question and is used in step 2.

Note: There are no specific curves given for Boston. You have to use a common set of curves given in the beginning of the Tide Tables which are suitable for tidal intervals between 5 hours and 7 hours. These are reproduced in Appendix 10.

Step 2: From the bracketing tides on that day, obtain tidal interval and range

Required: Afternoon, falling tide, height of 2.5m.

Bracketing tides:

Date	Time	Height (m)
19 January 20YY	1009	3.6m
19 January 20YY	1636	-0.5m

Tidal interval is 6h 27m and range is 4.1m

Note: The minus sign indicates that the tide is below chart datum.

Step 3: Draw sloping line on general curves

On the left side of the curves, locate the bracketed HW and LW heights and join them with a straight line as shown by a green line in figure 14.

Step 4: Draw vertical and horizontal lines

Required height of tide: 2.5m. Draw a vertical line at 2.5m to meet the sloping green line. From the point of intersection, draw a horizontal line, as shown in red colour in figure 14, across the curves for falling tide.

Step 5: Draw vertical line at appropriate curve and compute answer

Bracketed tidal interval = 6h 27m. Note the points where the horizontal red line meets the 6h and the 7h curves as shown in blue colour in figure 14.

Interpolate visually in figure 14 for 6h 27m between the curves for 6h and 7h and draw a vertical line, as shown in red colour in figure 14. Read off the interval after HW and compute the required time which is 2h 10m after HW in this case. Required time = 1009 + 2h 20m = 1229 LT.

Step 6: State your answer

The latest time on the afternoon of 19 January 20YY, at Boston (USA east coast), when your ship drawing 3.5m at the after end can cross a bar marked 2.0m on the chart with UKC of 1.0m is **1229 LT**.

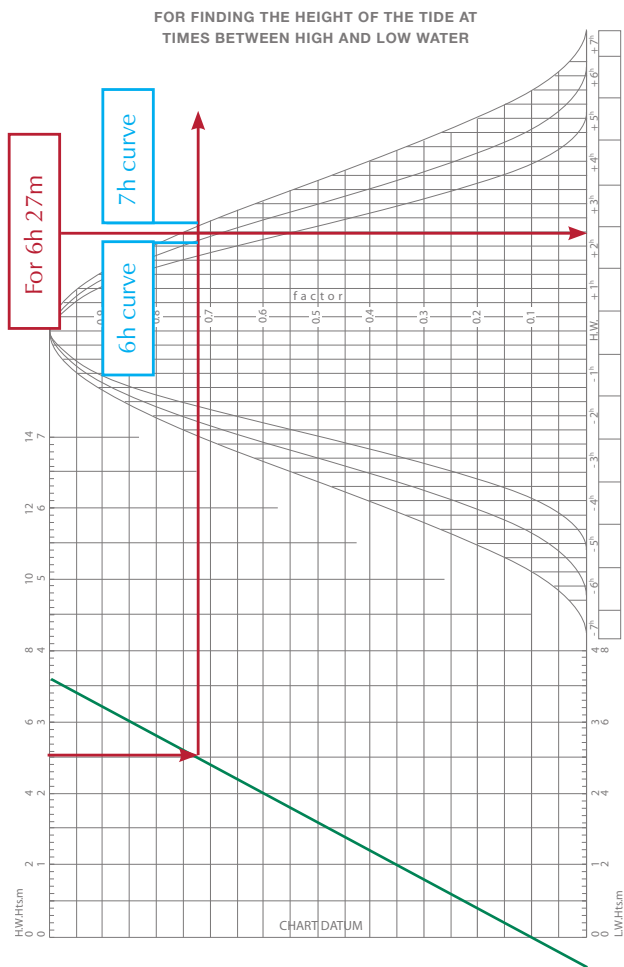


Figure 14

Test yourself

Computing required time

Answers are given after each question. Worked solutions in detail are given in subsequent pages.

Question 1

On the very early hours of 3 April 20YY, at Sheerness (England), find the latest time when your ship drawing 5.0m can sail over a bar marked 2.5m on the chart with UKC of 0.5m, using the curve in Appendix 11 and the tidal extracts below:

Date	Time (LT)	Height (m)
3 April 20YY	0027	5.6m
3 April 20YY	0645	0.6m

If the ship is ready to sail earlier by a few hours, what is the earliest time that it can sail?

Answer: Latest 0312 LT on 3 April. Earliest 2107 LT on 2 April.

Question 2

On the afternoon of 4 March 20YY, at Lisbon (Portugal), find the latest time when your ship drawing 4.5m can sail over a bar marked 3.0m on the chart with UKC of 1.5m, using the curve in Appendix 12 and the tidal extracts below:

Date	Time (LT)	Height (m)
4 March 20YY	1524	3.6m
4 March 20YY	2051	0.7m

Answer: 1704 LT.

Question 3

Your ship expects to complete loading at 1800 LT on 6 January 20YY, at Kuwait (Mina Al Ahmadi) with draft aft of 6.5m. Find the earliest time you can sail out with UKC of 1.0m over a bar marked 5.0m on the chart, using the curves in Appendix 10 and the tidal extracts below:

Date	Time (LT)	Height (m)
6 January 20YY	1820	1.7m
7 January 20YY	0005	2.9m

Answer: 2235 LT on 6 January.

Question 4

Your ship expects to complete loading at 0500 LT on 17 February 20YY, at Twin Island, Torres Strait, (Australia) with draft of 5.5m. Find the earliest time you can sail out with UKC of 1.5m over a bar marked 4.0m on the chart, using the curves in Appendix 10 given the tidal extracts below:

Date	Time (LT)	Height (m)
17 February 20YY	0535	0.2m
17 February 20YY	1138	3.7m

Answer: 0958 LT.

Question 5

Your ship expects to arrive at Elephant Point, Rangoon River (Myanmar) at 0200 LT on 16 April 20YY, with draft of 5.0m aft. Find the latest time you can pass over a bar with UKC of 1.0m over a bar marked 2.0m on the chart, using the curves in Appendix 10 given the tidal extracts below:

Date	Time (LT)	Height (m)
16 April 20YY	0246	6.0m
16 April 20YY	0912	0.9m

Answer: 1202 LT.

Detailed solutions on computation of time

Question 1

On the very early hours of 3 April 20YY, at Sheerness (England), find the latest time when your ship, drawing 5.0m, can sail over a bar marked 2.5m on the chart with UKC of 0.5m, using the curve in Appendix 11 and the tidal extracts below:

Date	Time (LT)	Height (m)
3 April 20YY	0027	5.6m
3 April 20YY	0645	0.6m

If the ship is ready to sail a few hours earlier, what is the earliest time that it can sail?

Note: 'Latest time' indicates falling tide and earliest, rising tide.

Preliminary calculation

DRAFT	5.0m
UKC	0.5m
Required depth	5.5m
Charted depth	2.5m
Required height of tide	3.0m

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 1: The UK and Ireland (including European Channel Ports).

Look at the index to standard ports on the inside of the front cover (Appendix 1), locate Sheerness, and open to that page. For convenience, data from that page is given in the question and used in step 2.

Step 2: Extract the bracketing tides and compute the range and tidal interval

Required: very early morning, falling tide, height of 3.0m. Bracketing tides:

Date	Time (LT)	Height (m)
3 April 20YY	0027	5.6m
3 April 20YY	0645	0.6m

Bracketed tidal interval 6h 18m, range 5.0m.

Step 3: Draw a sloping line on the curves of the port

On the left side of the curves of that port locate the bracketed HW and LW heights and join them with a straight line as shown by the green line in figure 15.

Step 4: Draw vertical and horizontal lines

Required height of tide: 3.0m. Draw a vertical line at 3.0m to meet the sloping green line. From the point of intersection, draw a horizontal line, as shown in red colour in figure 15, across the curves for **falling** tide.

Step 5: Draw a vertical line at the appropriate curve and compute the time

The firm curve is for mean spring range of	5.1m
The dotted curve is for mean neap range of	3.3m
Bracketed range from step 2	5.0m

Note the points where the horizontal red line meets the mean spring range curve and the mean neap range curve. In this case there is only one curve on the falling tide.

At the point of intersection, draw a vertical line, as shown by the red colour in figure 15. Read off the interval after HW and compute the required time which is 2h 45m after HW in this case. Required time = 0027 + 2h 45m = 0312 LT.

Step 6: State your answer

On the very early hours of 3 April 20YY, at Sheerness (England), the latest time when your ship drawing 5.0m can sail over a bar marked 2.5m on the chart with UKC of 0.5m is 0312 LT.

If ready to sail a few hours earlier:

From the point where the horizontal line in step 5 crosses the rising tide, draw a vertical line as shown by the blue dotted line in figure 5, and read off the interval before HW. In this case it is 03h 20m before HW.

The ship can sail as early as: 0027 - 0320 = 2107 on 2 April.

Answer: Earliest time 2107 LT on 2 April.

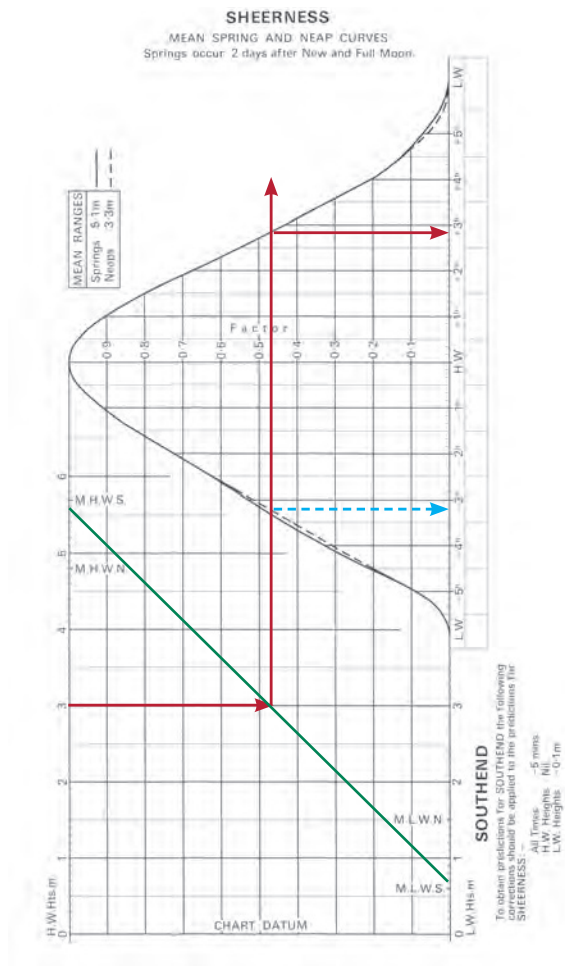


Figure 15

Question 2

On the afternoon of 4 March 20YY, at Lisbon (Portugal), find the latest time when your ship drawing 4.5m can sail over a bar marked 3.0m on the chart with UKC of 1.5m using the curve in Appendix 12 and the tidal extracts below:

Date	Time (LT)	Height (m)
4 March 20YY	1524	3.6m
4 March 20YY	2051	0.7m

Note: 'Latest time' indicates falling tide.

Preliminary calculation

DRAFT	4.5m
UKC	1.5m
Required depth	6.0m
Charted depth	3.0m
Required height of tide	3.0m

Step 1: I identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 8: South East Atlantic Ocean, West Africa and Mediterranean (including tidal stream tables). Look at the index to standard ports on the inside of the front cover (Appendix 7), locate Lisbon, and open to that page. The data extracted from that page is given in the question and is used in step 2.

Step 2: Extract the bracketing tides and compute the range and tidal interval

Required: Afternoon, falling tide, height of 3.0m. Bracketing tides:

Date	Time (LT)	Height (m)
4 March 20YY	1524	3.6m
4 March 20YY	2051	0.7m

Extracted tidal interval 5h 27m; range 2.9m.

Step 3: Draw a sloping line on the curves of the port

On the left side of the curves of that port locate the bracketed HW and LW heights and join them with a straight line as shown by the green line in figure 16.

Step 4: Draw vertical and horizontal lines

Required height of tide: 3.0m. Draw a vertical line at 3.0m to meet the sloping green line. From the point of intersection, draw a horizontal line, as shown by the red colour in figure 16, across the curves for falling tide.

Step 5: Draw a vertical line at the appropriate curve and compute time

The firm curve is for mean spring range of	3.3m
The dotted curve is for mean neap range of	1.6m
Bracketed range from step 2	2.9m

Step 6: State your answer

On the afternoon of 4 March 20YY, at Lisbon (Portugal), the latest time a ship drawing 4.5m can sail over a bar marked 3.0m on the chart with UKC of 1.5m is **1704 LT**.

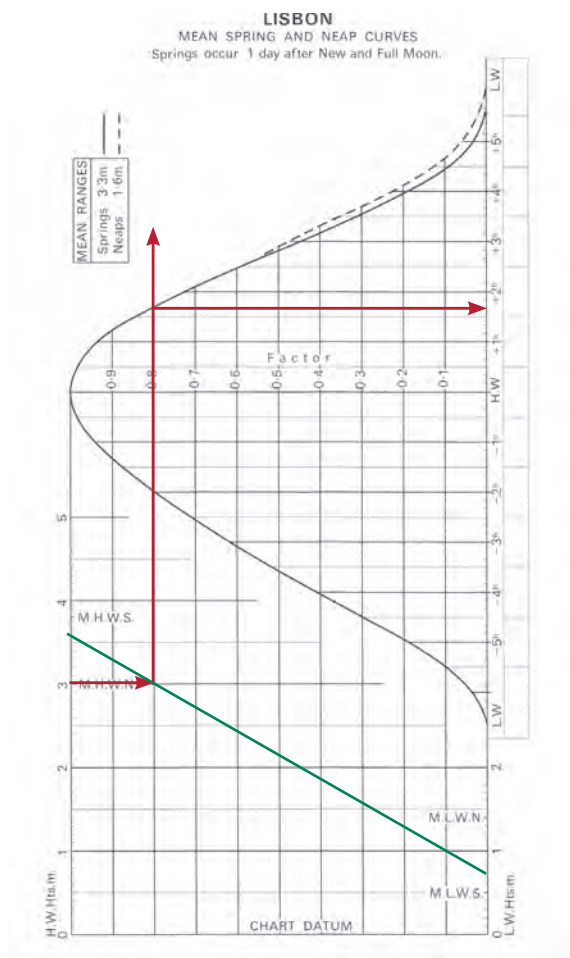


Figure 16

Question 3

Your ship expects to complete loading at 1800 LT on 6 January 20YY, at Kuwait (Mina Al Ahmadi) with draft aft of 6.5m. Find the earliest time you can sail out with UKC of 1.0m over a bar marked 5.0m on the chart, using the curves in Appendix 10 given the tidal extracts below:

Date	Time (LT)	Height (m)
6 January 20YY	1820	1.7m
7 January 20YY	0005	2.9m

Required: Rising tide after 1800LT; height of 2.5m. Bracketing tides:

Note: 'Earliest time' indicates rising tide.

Preliminary calculation

DRAFT	6.5m
UKC	1.0m
Required depth	7.5m
Charted depth	5.0m
Required height of tide	2.5m

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 3: Indian Ocean (including Tidal stream tables).

Look at the Index to Standard Ports on the inside of the front cover (Appendix 3), locate Mina Al Ahmadi, and open to that page. For convenience, the extract for that day is given in the question and is used in step 2.

Note: There are no specific curves given for Mina Al Ahmadi. You have to use a common set of curves given in the beginning of the tides tables which are suitable for tidal intervals between 5 hours and 7 hours. These are reproduced in Appendix 10.

Step 2: From the bracketing tides on that day, obtain tidal interval and range.

Required: Rising tide after 1800LT; height of 2.5m. Bracketing tides:

Date	Time (LT)	Height (m)
6 January 20YY	1820	1.7m
7 January 20YY	0005	2.9m

Tidal interval 5h 45m; range 1.2m.

Step 3: Draw a sloping line on the general curves

On the left side of the curves, locate the bracketed HW and LW heights and join them with a straight line as shown by the green line in figure 17.

Step 4: Draw vertical and horizontal lines

Required height of tide: 2.5m. Draw a vertical line at 2.5m to meet the sloping green line. From the point of intersection, draw a horizontal line, as shown by the red colour in figure 17, across the curves for rising tide.

Step 5: Draw vertical line at appropriate curve and compute time

Note the points where the horizontal red line meets the 5h curve and the 6h curve. Interpolate visually on the horizontal red line for the required tidal interval 5h 45m (from step 2), and draw a vertical line, as shown by the red colour figure 17. Read off the interval, which is 1h 30m before HW in this case, and compute the required time.

Required time = 0005–2h 00m = 2205 LT on 6 January.

Step 6: State your answer

On 6 January 20YY, at Kuwait (Mina Al Ahmadi) with draft aft of 6.5m, the earliest time after 1800LT the ship can sail out with UKC of 1.0m, over a bar marked 5.0m, on the chart is **2205LT**.

[illegible]

Figure 17

Question 4

Your ship expects to complete loading at 0500 LT on 17 February 1992, at Twin Island, Torres Strait, (Australia) with draft of 5.5m. Find the earliest time you can sail out with UKC of 1.5m over a bar marked 4.0m on the chart, using the curves in Appendix 7 given the tidal extracts below:

Date	Time (LT)	Height (m)
17 February 20YY	0535	0.2m
17 February 20YY	1138	3.7m

Note: 'Earliest time' indicates rising tide.

Preliminary calculation

DRAFT	5.5m
UKC	1.5m
Required depth	7.0m
Charted depth	4.0m
Required height of tide	3.0m

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 4: South Pacific Ocean (including tidal stream tables). Look at the index to standard ports on the inside of the front cover (Appendix 4), locate Twin Island, Torres Strait, (Australia), and open to that page. For convenience, the extract for that day is given in the question and is used in step 2.

Note: There are no specific curves given for Twin Island. You have to use a common set of curves given in the beginning of the tide tables which are suitable for tidal intervals between 5 hours and 7 hours. These are reproduced in Appendix 10.

Step 2: From the bracketing tides on that day, obtain tidal interval and range

Required: Rising tide after 0500LT; height of 3.0m. Bracketing tides:

Date	Time (LT)	Height (m)
17 February 20YY	0535	0.2m
17 February 20YY	1138	3.7m

Tidal interval 6h 03m; range 3.5m.

Step 3: Draw a sloping line on the general curves

On the left side of the curves, locate the bracketed HW and LW heights and join them with a straight line as shown by a green line in figure 18.

Step 4: Draw vertical and horizontal lines

Required height of tide: 3.0m. Draw a vertical line at 3.0m to meet the sloping green line. From the point of intersection, draw a horizontal line, as shown by the red colour in figure 18, across the curves for rising tide.

Step 5: Draw a vertical line at the appropriate curve and compute time

Note the points where the horizontal red line meets the 6h curve and the 7h curve. Interpolate visually on the horizontal red line for the required tidal interval 6h 03m (from step 2), and draw a vertical line, as shown in red colour in figure 18. Read off the interval, which is 1h 40m before HW in this case, and compute the required time.

Required time = 1138 - 1h 40m = 0958 LT.

Step 6: State your answer

On 17 February 20YY, at Twin Island, Torres Strait, (Australia) with draft aft of 5.5m, the earliest time ship can sail out with UKC of 1.5m, over a bar marked 4.0m, on the chart is **0958 LT**.

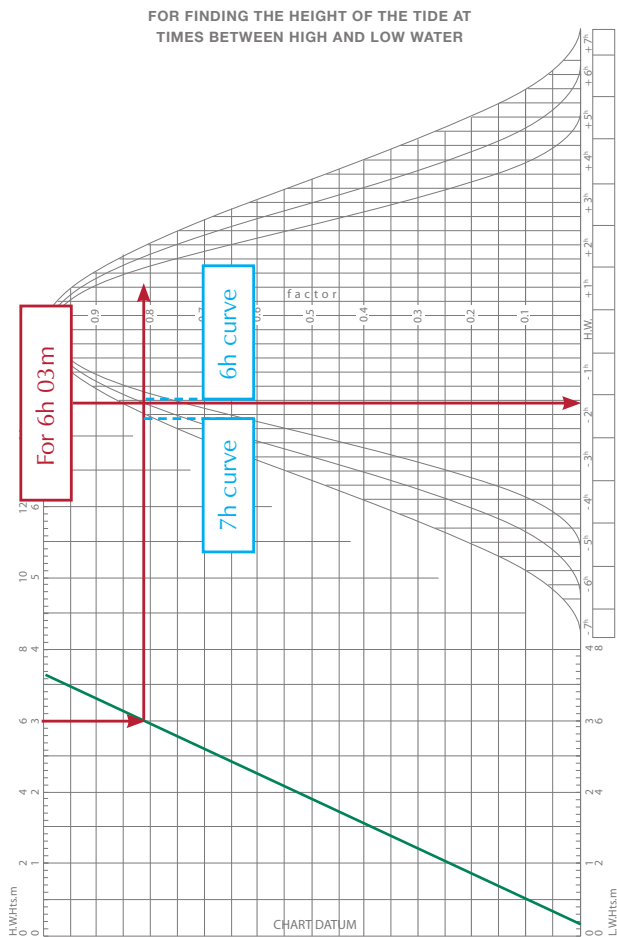


Figure 18

Question 5

Your ship expects to arrive at Elephant Point, Rangoon River (Myanmar) at 0200 LT on 16 April 20YY, with draft of 5.0m aft. Find the latest time you can pass over a bar with UKC of 1.0m over a bar marked 2.0m on the chart, using the curves in Appendix 10 given the tidal extracts below:

Date	Time (LT)	Height (m)
16 April 20YY	0246	6.0m
16 April 20YY	0912	0.9m

Note: 'Latest time' indicates falling tides.

Preliminary calculation

DRAFT	5.0m
UKC	1.0m
Required depth	6.0m
Charted depth	2.0m
Required height of tide	4.0m

Step 1: Identify the appropriate ATT and open to the page of the given port

In this case, it is ATT for the year 20YY Volume 3: Indian Ocean (including tidal stream tables). Look at the Index to Standard Ports on the inside of the front cover (Appendix 3), locate Elephant Point, Rangoon River (Myanmar), and open to that page. For convenience, the extract for that day is given in the question and is used in step 2.

Note: There are no specific curves given for Elephant Point. You have to use a common set of curves given in the beginning of the tide tables which are suitable for tidal intervals between 5 hours and 7 hours. These are reproduced in Appendix 10.

Step 2: From the bracketing tides on that day, obtain tidal interval and range.

Required: Falling tide after 0200 LT; height of 4.0m. Bracketing tides:

Date	Time (LT)	Height (m)
16 April 20YY	0246	6.0m
16 April 20YY	0912	0.9m

Tidal interval 6h 26m; range 5.1m.

Step 3: Draw a sloping line on the general curves

On the left side of the curves, locate the bracketed HW and LW heights and join them with a straight line as shown by a green line in figure 19.

Step 4: Draw vertical and horizontal lines

Required height of tide: 4.0m. Draw a vertical line at 4.0m to meet the sloping green line. From the point of intersection, draw a horizontal line, as shown by the red colour in figure 19, across the curves for falling tide.

Step 5: Draw a vertical line at the appropriate curve and compute time

Note the points where the horizontal red line meets the 6h curve and the 7h curve. Interpolate visually on the horizontal red line for the required tidal interval 6h 26m (from step 2), and draw a vertical line, as shown in red colour in figure 19. Read off the interval, which is 2h 50m after HW in this case, and compute the required time.

Required time = 0912 + 2h 50m = 1202 LT.

Step 6: State your answer

On 16 April 20YY, at Elephant Point, Rangoon River (Myanmar), the latest time the ship can sail out with draft aft of 5.0m, and UKC of 1.0m, over a bar marked 2.0m on the chart is **1202 LT**.



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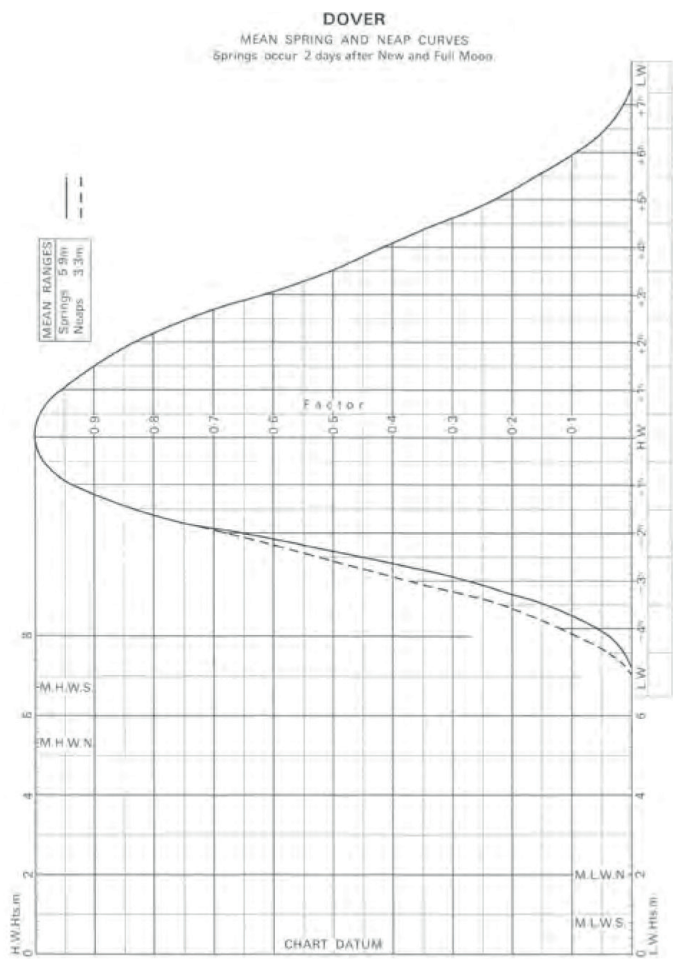
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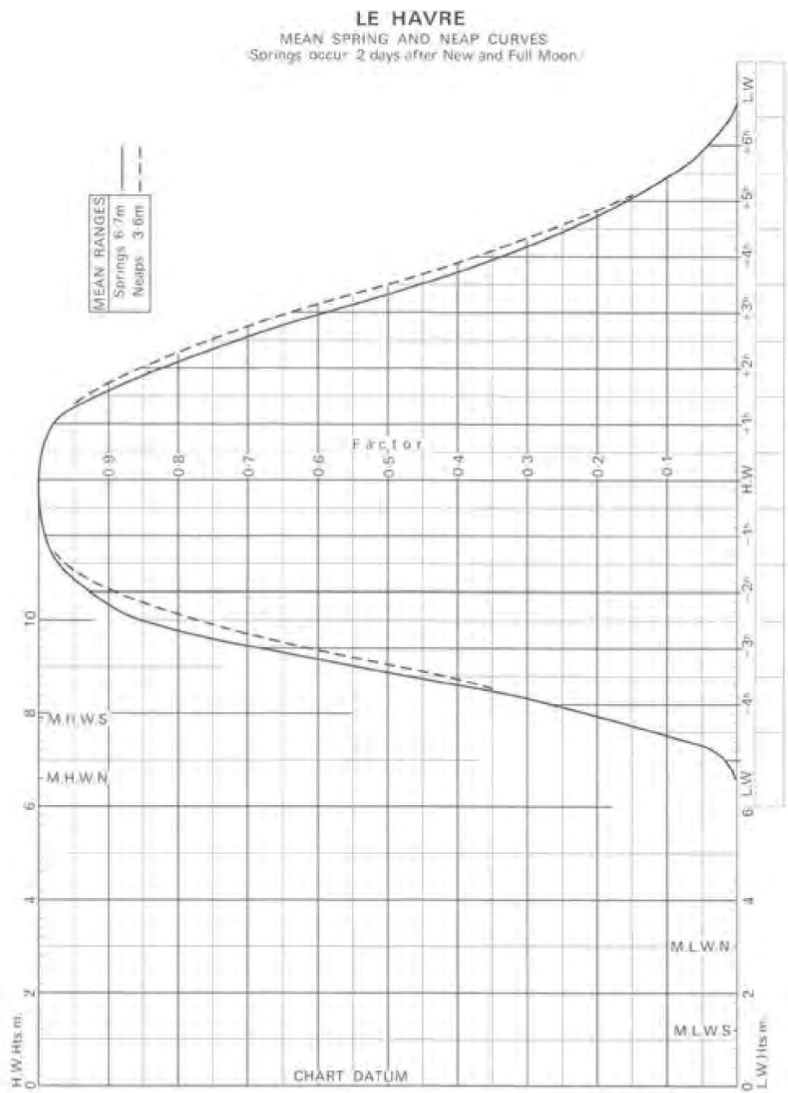
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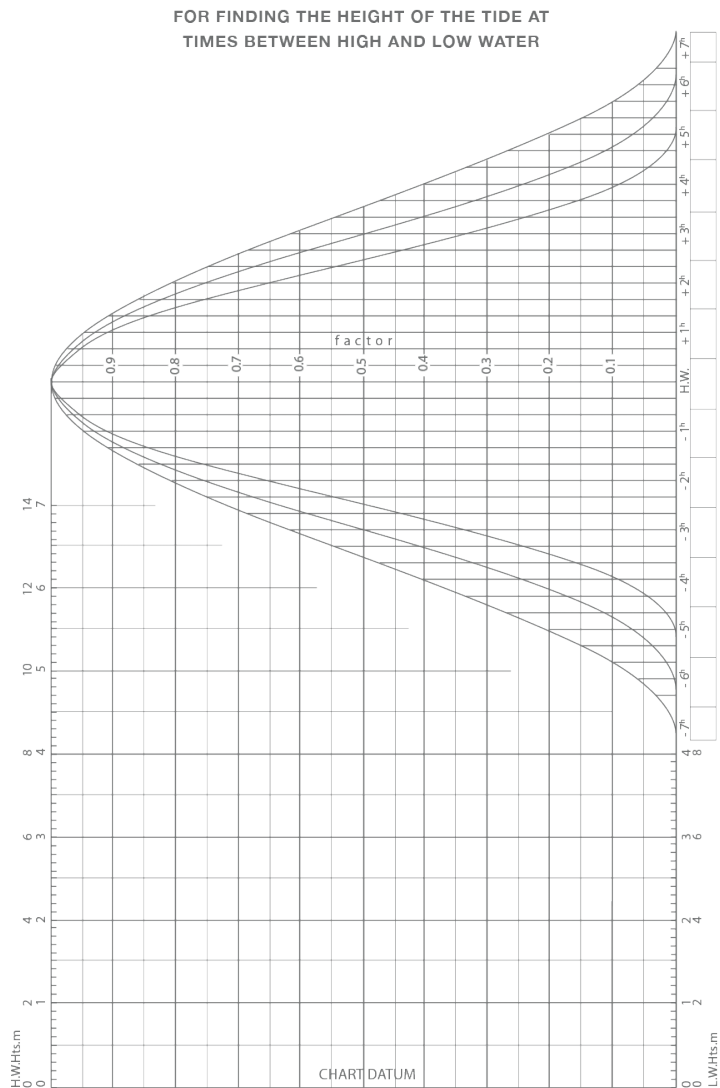
► Tidal Curves:
Dover



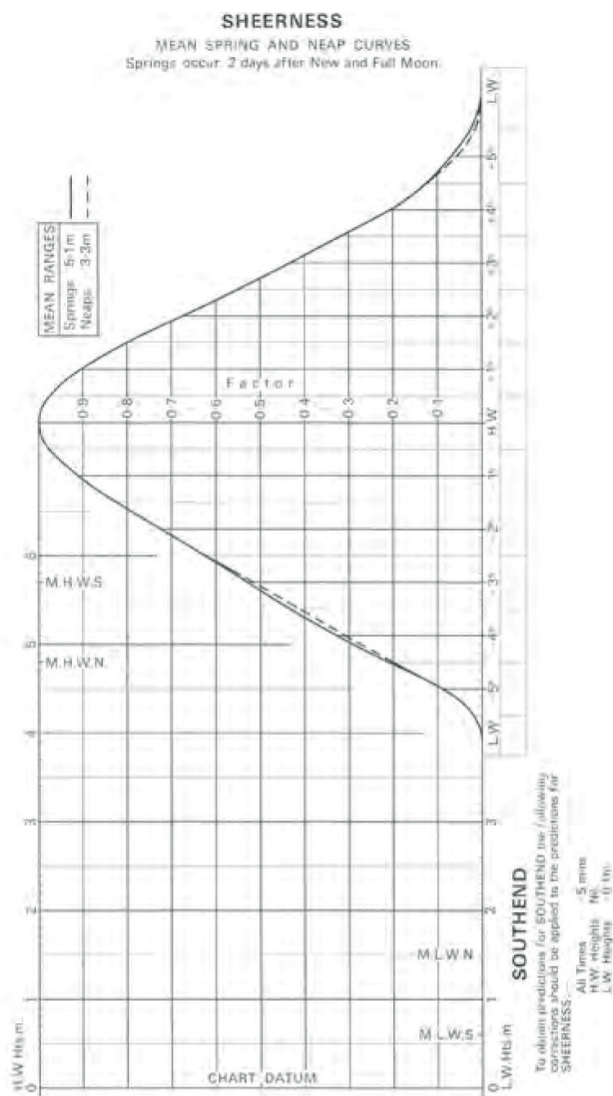
► Tidal Curves:
Le Havre



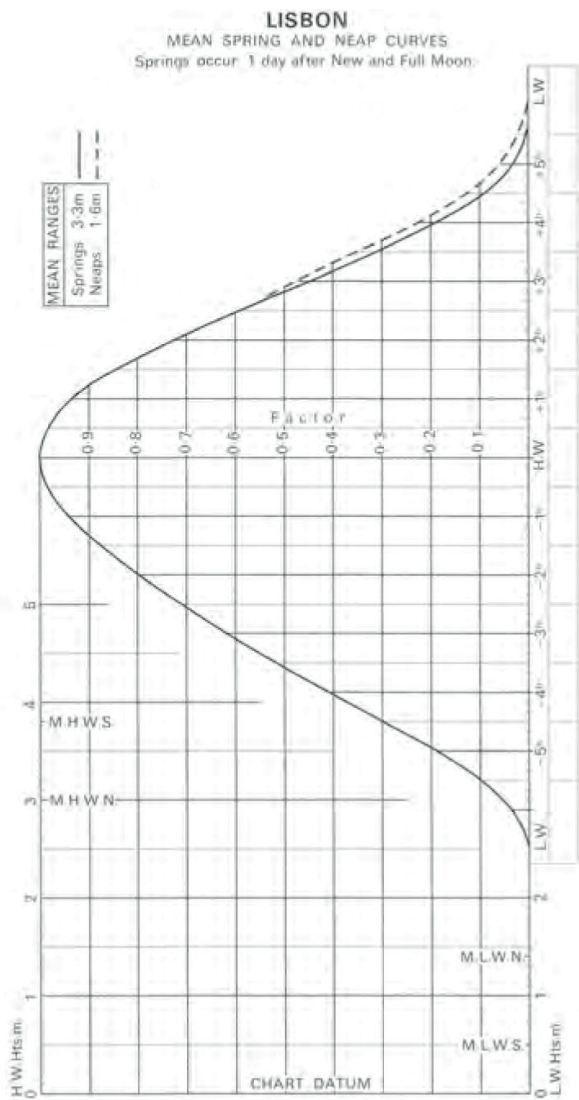
► Tidal Curves:
General



► Tidal Curves:
Sheerness



► Tidal Curves:
Lisbon



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