

Form 5: Chapter 6
Ratios and Graphs of Trigonometric Functions
Fully-worked Solutions

UPSKILL 6.1

1

Angle	Quadrant	sine	cosine	tangent
α	II	Coordinate- $y = 0.6$	Coordinate- $x = -0.8$	$\frac{\text{Coordinate-}y}{\text{Coordinate-}x} = -0.75$
β	III	Coordinate- $y = -0.8$	Coordinate- $x = -0.6$	$\frac{\text{Coordinate-}y}{\text{Coordinate-}x} = 1.33$
δ	IV	Coordinate- $y = -0.92$	Coordinate- $x = 0.4$	$\frac{\text{Coordinate-}y}{\text{Coordinate-}x} = -2.3$

- 2** (a) Positive, $\sin 56^\circ$
 (b) Negative, $-\sin 15^\circ$
 (c) Negative, $-\sin 71^\circ$
 (d) Negative, $-\cos 75^\circ$
 (e) Negative, $-\cos 9^\circ$
 (f) Positive, $\cos 56^\circ$
 (g) Negative, $-\tan 6^\circ$
 (h) Positive, $\tan 75^\circ$
 (i) Negative, $-\tan 19^\circ$

3 (a) $\cos 150^\circ = -\cos (180^\circ - 150^\circ)$

$$= -\cos 30^\circ$$

$$= -\frac{\sqrt{3}}{2}$$

(b) $\sin 225^\circ = -\sin (225^\circ - 180^\circ)$

$$= -\sin 45^\circ$$

$$= -\frac{1}{\sqrt{2}}$$

(c) $\sin 240^\circ = -\sin (240^\circ - 180^\circ)$

$$= -\sin 60^\circ$$

$$= -\frac{\sqrt{3}}{2}$$

(d) $\cos 315^\circ = \cos (360^\circ - 315^\circ)$

$$= \cos 45^\circ$$

$$= \frac{1}{\sqrt{2}}$$

(e) $\cos 210^\circ = -\cos (210^\circ - 180^\circ)$

$$= -\cos 30^\circ$$

$$= -\frac{\sqrt{3}}{2}$$

(f) $\tan 150^\circ = -\tan (180^\circ - 150^\circ)$

$$= -\tan 30^\circ$$

$$= -\frac{1}{\sqrt{3}}$$

$$\begin{aligned} \text{(g) } \tan 240^\circ &= \tan (240^\circ - 180^\circ) \\ &= \tan 60^\circ \\ &= \sqrt{3} \end{aligned}$$

$$\begin{aligned} \text{(h) } \tan 330^\circ &= -\tan (360^\circ - 330^\circ) \\ &= -\tan 30^\circ \\ &= -\frac{1}{\sqrt{3}} \end{aligned}$$

4 (a) $\sin \alpha = 0.6124$

Basic $\angle = 37.76^\circ$

$\alpha = 37.76^\circ$ or 142.24°

(b) $\cos \alpha = 0.2388$

Basic $\angle = 76.18^\circ$

$\alpha = 76.18^\circ$ or 283.82°

(c) $\tan \alpha = 2.7892$

Basic $\angle = 70.28^\circ$

$\alpha = 70.28^\circ$ or 250.28°

(d) $\sin \alpha = -0.8552$

Basic $\angle = 58.78^\circ$

$\alpha = 238.78^\circ$ or 301.22°

(e) $\cos \alpha = -0.7268$

Basic $\angle = 43.38^\circ$

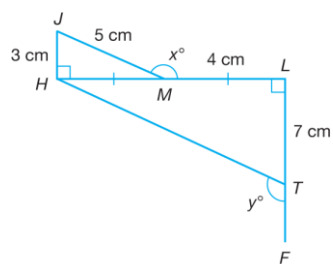
$\alpha = 136.62^\circ$ or 223.38°

(f) $\tan \alpha = -2.3578$

Basic $\angle = 67.02^\circ$

$\alpha = 112.98^\circ$ or 292.98°

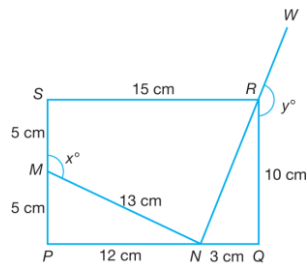
5



(a) $\cos x^\circ = -\cos \angle JMH = -\frac{4}{5}$

(b) $\tan y^\circ = -\tan \angle HLT = -\frac{8}{7}$

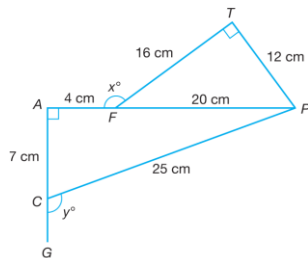
6



(a) $\cos x^\circ = \cos \angle PMN = -\frac{5}{13}$

(b) $\tan y^\circ = -\tan \angle NRQ = -\frac{3}{10}$

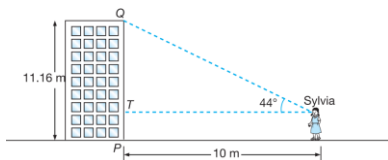
7



(a) $\sin x^\circ = \sin \angle TFP = \frac{12}{20} = \frac{3}{5}$

(b) $\cos y^\circ = -\cos \angle ACP = -\frac{7}{25}$

8



$$\tan 44^\circ = \frac{QT}{10}$$

$$QT = 10 \times \tan 44^\circ$$

$$QT = 9.66 \text{ m}$$

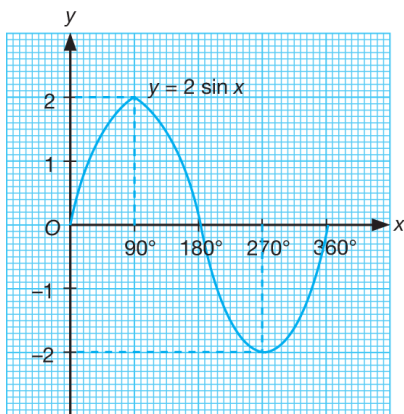
$$PT = 11.16 - 9.66 = 1.5 \text{ m}$$

$$\tan \angle TSP = \frac{1.5}{10}$$

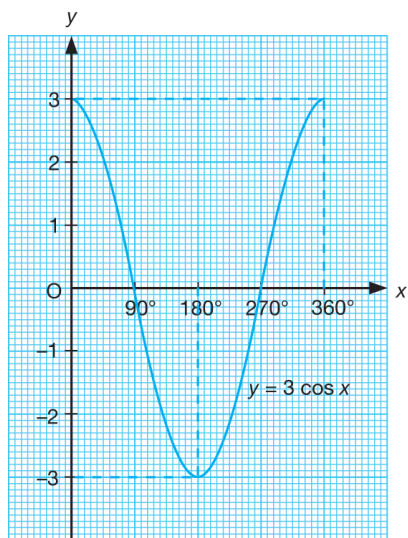
$$\text{Angle of depression} = 8^\circ 33'$$

UPSKILL 6.2

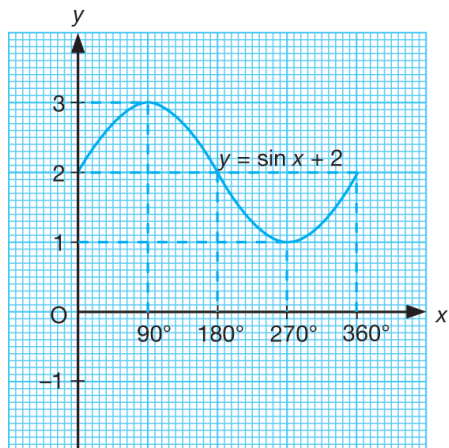
1 (a)



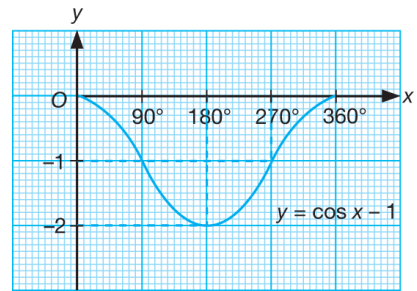
(b)



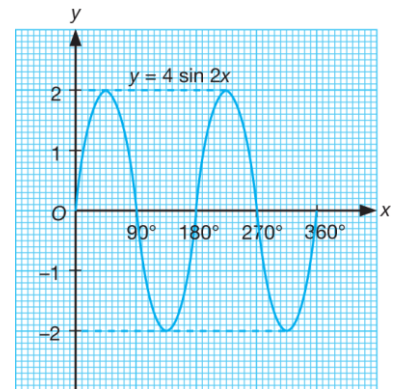
(c)



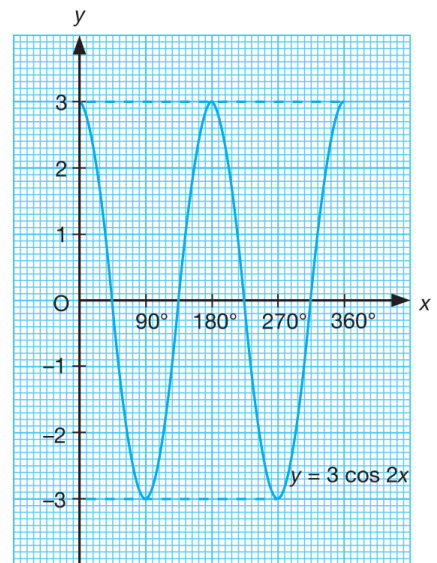
(d)



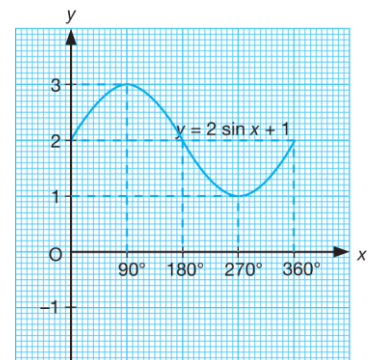
2 (a)



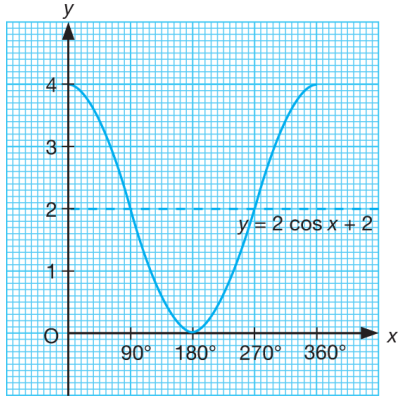
(b)



(c)



(d)



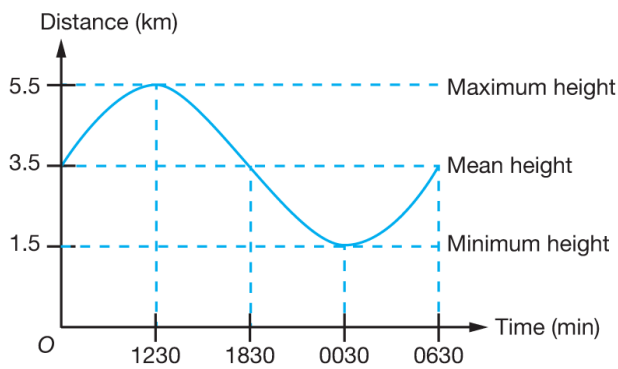
3 $V = A \sin 93\,600t$

$93\,600t = 360$

$t = \frac{1}{260}$

Period = $\frac{1}{260}$ seconds

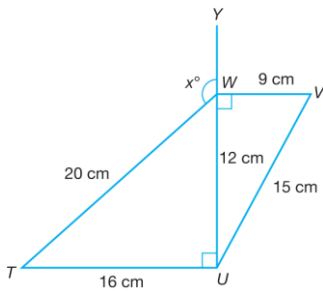
4



Summative Practice 6

Multiple-Choice Questions

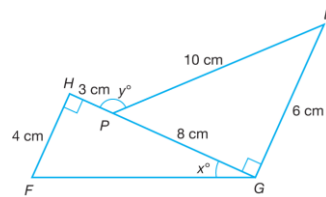
1



$\cos x^\circ = -\cos \angle TWU = -\frac{12}{20} = -\frac{3}{5}$

Answer: B

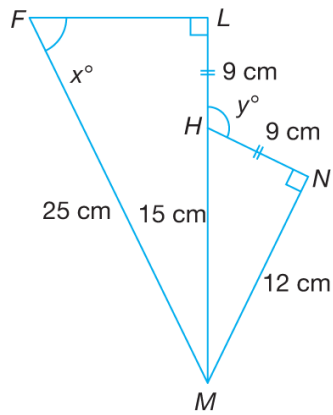
2



$\cos y^\circ = -\cos \angle LPQ = -\frac{8}{10} = -\frac{3}{5}$

Answer: A

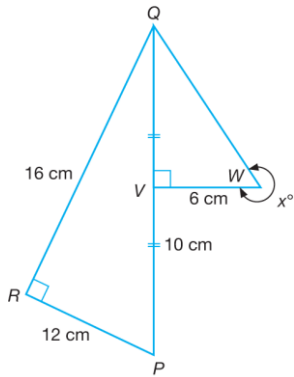
3



$$\cos y^\circ = -\frac{9}{15} = -\frac{3}{5}$$

Answer: A

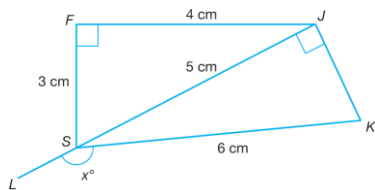
4



$$\tan x^\circ = -\tan \angle VWQ = -\frac{10}{6} = -\frac{5}{3}$$

Answer: D

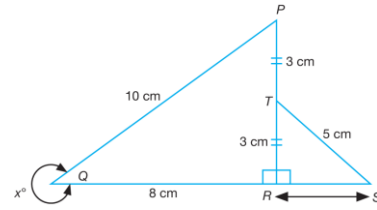
5



$$\cos x^\circ = -\frac{5}{6}$$

Answer: A

6

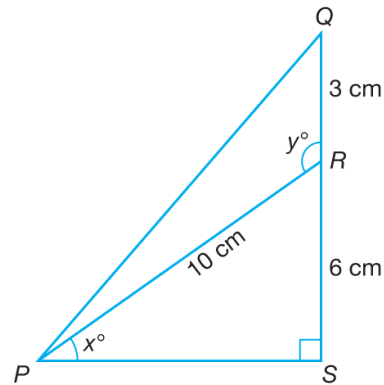


$$\tan x^\circ = -\tan \angle PQR = -\frac{6}{8} = -\frac{3}{4}$$

Answer: C

Structured Questions

1



(a) $\sin x^\circ = \frac{6}{10}$

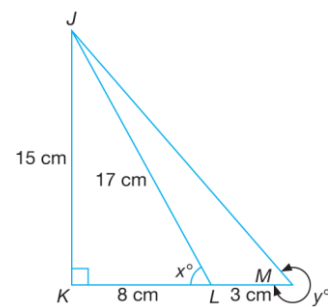
Basic $\angle = 26^\circ 53'$

$$x^\circ = 36^\circ 52'$$

(b) $\cos y^\circ = -\frac{6}{10}$

$$y = 180^\circ - 53^\circ 8' = 126^\circ 52'$$

2



(a) $\sin x^\circ = \frac{15}{17}$

$$x = 61^\circ 56'$$

(b) $\tan y^\circ = -\tan \angle JMK$
 $= -\frac{15}{11}$

Basic $\angle = 53^\circ 45'$

$y = 306^\circ 15'$

3 (a) $\sin x = 0.8290$

Basic $\angle = 56^\circ$

$x = 56^\circ, 124^\circ$

(b) $\cos x = -0.8290$

Basic $\angle = 34^\circ$

$x = 146^\circ, 214^\circ$

4 (a) $\cos y = 0.2588$

Basic $\angle = 75^\circ$

$y = 75^\circ, 285^\circ$

(b) $\tan y = -0.6249$

Basic $\angle = 32^\circ$

$y = 148^\circ, 328^\circ$

5 (a) $\cos z = 0.9659$

Basic $\angle = 15^\circ$

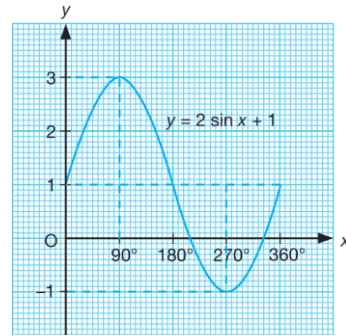
$z = 15^\circ, 345^\circ$

(b) $\sin z = -0.2588$

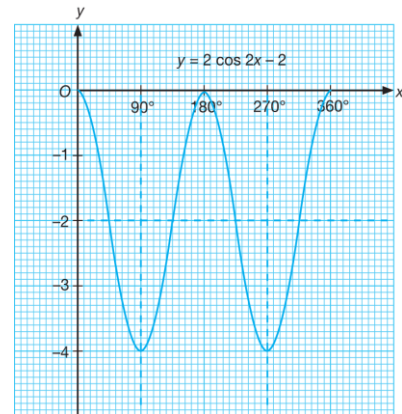
Basic $\angle = 15^\circ$

$z = 195^\circ, 345^\circ$

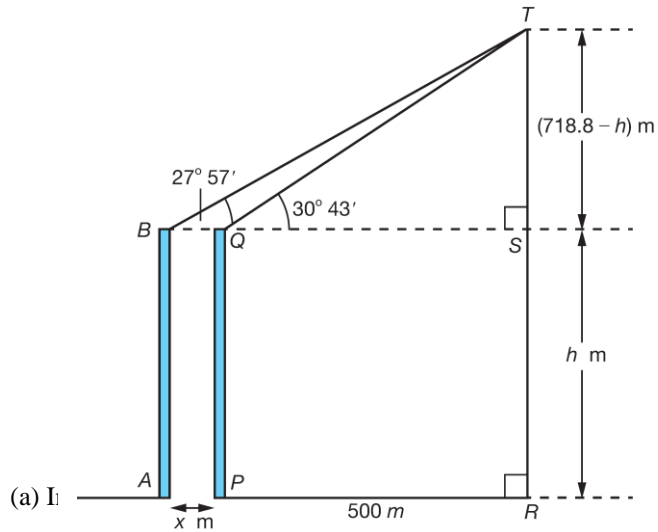
6



7



8



(a) I

$$\begin{aligned}
 500 \times \tan 30^\circ 43' &= 718.8 - h \\
 297.075 &= 718.8 - h \\
 h &= 718.8 - 297.075 \\
 h &= 421.7 \text{ m}
 \end{aligned}$$

Hence, the height of the Petronas Twin Towers is 421.7 m.

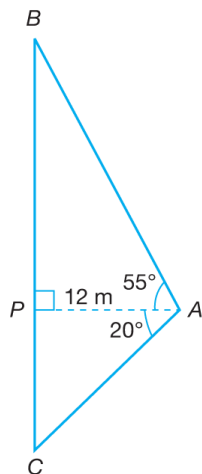
(b) In $\triangle TBS$,

$$\tan 27^\circ 57' = \frac{718.8 - 421.7}{500 + x}$$

$$\begin{aligned}
 (500 + x) \times \tan 27^\circ 57' &= 297.1 \\
 265.30 + 0.5306x &= 297.1 \\
 0.5306x &= 31.8 \\
 x &= 59.9
 \end{aligned}$$

Hence, the horizontal distance between the two towers is 59.9 m.

9



In $\triangle APB$,

$$\tan 55^\circ = \frac{PB}{12}$$

$$PB = 17.138 \text{ m}$$

In $\triangle APC$,

$$\tan 20^\circ = \frac{PC}{12}$$

$$PC = 12 \times \tan 20^\circ$$

$$PC = 4.368 \text{ m}$$

$$BC = 17.138 + 4.368 = 21.51 \text{ m}$$

10 (a) $y = 6 + 2 \sin 30t$

When $30t = 360$,

$$t = 12$$

Period = 12 hours

(b) $y = 6 + 2(1) = 8$

$$\sin 30t = 1$$

$$30t = 90$$

$$t = 3$$

The level of sea water is the highest at 3 a.m. with a depth of 8 m.

(c) $y = 6 + 2(-1) = 4$

$$\sin 30t = -1$$

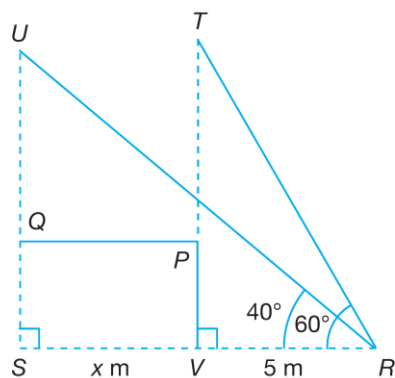
$$30t = 270$$

$$t = 9$$

The level of sea water is the lowest at 9 a.m. with a depth of 4 m.

SPM SPOT

1



In $\triangle TVR$,

$$\tan 60^\circ = \frac{TV}{5}$$

$$TV = 5 \times \tan 60^\circ$$

$$TV = 8.66025 \text{ m}$$

In $\triangle USR$,

$$\tan 40^\circ = \frac{8.66025}{x+5}$$

$$(x+5) \tan 40^\circ = 8.66025$$

$$0.83910x + 4.19552 = 8.66025$$

$$0.83910x = 8.66025 - 4.19552$$

$$0.83910x = 4.46473$$

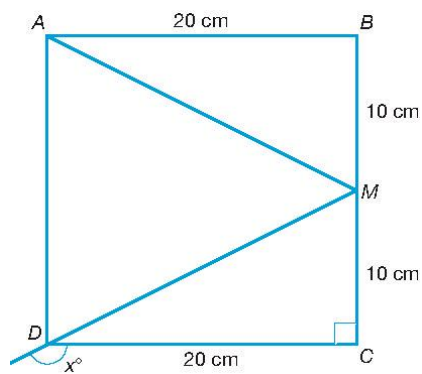
$$x = \frac{4.46473}{0.83910}$$

$$x = 5.321$$

$$PQ = 5.321 \text{ m}$$

Answer: A

2 (a)



(i) $DM = \sqrt{20^2 + 10^2} = 22.36 \text{ cm}$

(ii) $\cos x^\circ = -\cos \angle MDC$

$$= -\frac{20}{22.36}$$

$$= -\mathbf{0.8945}$$

(b)

