

Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 1

1. Express each of the following as fractions or integers:

(a) $16^{\frac{3}{4}}$ (b) $27^{-\frac{1}{3}}$ (c) $4^{\frac{3}{2}}$ (d) $36^{\frac{1}{2}}$ (e) $8^{-\frac{2}{3}}$

2. Simplify:

(a) $a^5 \div a^2$ (b) $a^{-4} \times a^5$ (c) $(a^8)^{\frac{1}{4}}$ (d) $(a^2 b^{-2})^{-1}$

Answers

1. (a) 8 (b) $\frac{1}{3}$ (c) 8 2. (a) a^3 (b) a (c) a^2
(d) $\frac{1}{6}$ (e) $\frac{1}{4}$ (d) $a^{-2} b^2$ (or $\frac{b^2}{a^2}$)

Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 2

1. The surface area of a sphere is given by

$$S = 4\pi r^2$$

- (a) Rearrange the formula to give r in terms of S .
- (b) Find the value of r when $S = 250 \text{ cm}^2$.
2. The formula $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ can be used to find the focal length, f , of a concave or convex lens.
- (a) Rearrange this formula to give u in terms of v and f .
- (b) What is the value of u when $f = 1$ and $v = -4$?
3. Rearrange the formula $T = 2\pi \sqrt{\frac{l}{g}}$ to give l in terms of T and g . Hence find l when $g = 10$ and $T = 2$.
4. Make x the subject of each of the following formulae.
- (a) $y = \frac{x}{x-1}$ (b) $y = \frac{x+1}{x-2}$ (c) $y = \frac{1}{\sqrt{x+1}}$
5. In each of the following, combine the fractions into a single fraction.
- (a) $\frac{2}{x} + \frac{1}{(x+1)}$ (b) $\frac{1}{x+2} + \frac{1}{x-2}$ (c) $\frac{x}{x+3} - \frac{x+1}{x-2}$

Answers

1. (a) $r = \sqrt{\frac{S}{4\pi}}$ (b) 4.46 cm
2. (a) $u = \frac{fv}{v-f}$ (b) 0.8
3. $l = g \left(\frac{T}{2\pi} \right)^2$, 1.01 (1 d.p.)
4. (a) $x = \frac{y}{y-1}$ (b) $x = \frac{2y+1}{y-1}$
- (c) $x = \frac{1}{y^2} - 1$ or $\frac{1-y^2}{y^2}$
5. (a) $\frac{3x+2}{x(x+1)}$ (b) $\frac{2x}{x^2-4}$
- (c) $\frac{-3(2x+1)}{(x+3)(x-2)}$

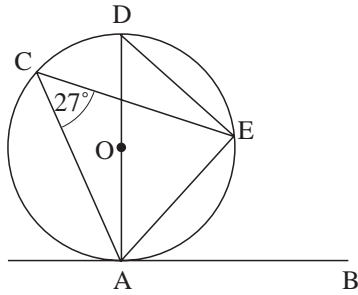
Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 3

1.



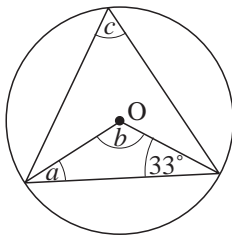
In the diagram, O is the centre of the circle,
 AD is the diameter,
 AB is a tangent,
 angle $ACE = 27^\circ$.

Find:

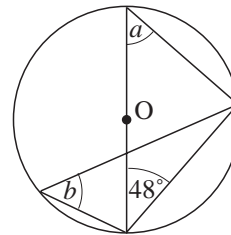
- (a) angle ADE (b) angle DAE (c) angle EAB (d) angle AOE

2. Find the angles marked in each diagram:

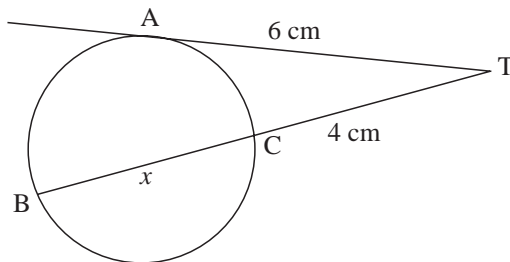
(a)



(b)

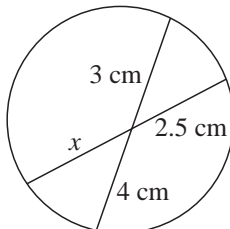


3.



AT is a tangent to the circle.
 Find the length BC.

4.

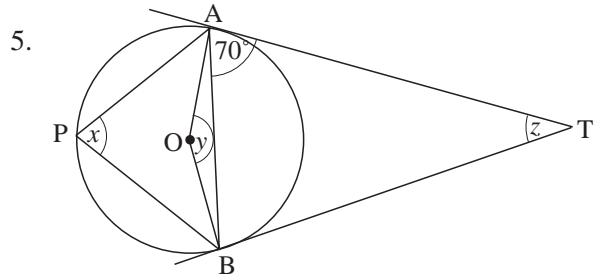


Find the length marked x .

Quick Check

Higher Tier

UNIT 3



AT, BT are tangents to the circle, which has centre O.

Find the size of the angles marked:

- (a) x (b) y (c) z

Answers

1. (a) 27° (b) 63° (c) 27° (d) 54° 3. 5 cm
 2. (a) $a = 33^\circ$, $b = 114^\circ$, $c = 57^\circ$ 4. 4.8 cm
 (b) $a = 42^\circ$, $b = 42^\circ$ 5. (a) 70° (b) 140° (c) 40°

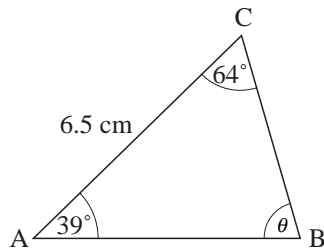
Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

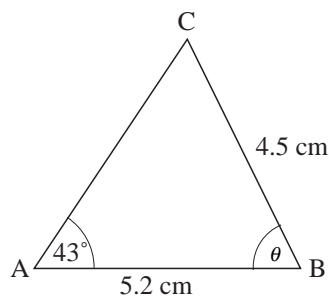
UNIT 4

1.



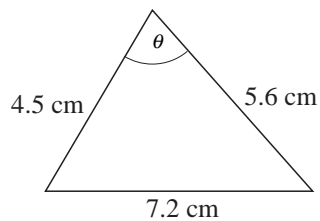
- (a) Find the angle θ .
 (b) Find the distance BC.

2.



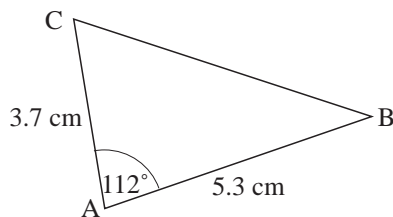
Find the two possible angles θ , and, in each case, calculate AC.

3.



Find the angle θ .

4.



Calculate the distance BC.

5. (a) For $0 \leq x \leq 360^\circ$, find all solutions of $\sin x^\circ = 0.5$.
 (b) The angle x satisfies

$$\cos x^\circ = \cos 210^\circ \text{ where } x \neq 210^\circ$$

Find x in the range $0 \leq x \leq 360^\circ$.

Answers

1. (a) 77° (b) 4.20 cm (2 d.p.) 4. 7.51 cm (2 d.p.)
 2. 85° and 9° ; 6.57 cm and 1.03 cm (2 d.p.) 5. (a) $30^\circ, 150^\circ$ (b) 150°
 3. 90.3° (1 d.p.)

Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 5

1. Andrew and Matthew play three games of badminton.
 The probability of Andrew winning the first game is 0.3. If he wins a game, the probability of his winning the next game is 0.5
 If Matthew wins a game, the probability of his winning the next game is 0.8.
 - (a) Draw a tree diagram to show all possible outcomes.
 - (b) Calculate the probability that Andrew wins all three games.
 - (c) Calculate the probability that Matthew wins at least two games.

Answers

1. (a)

(b) 0.075
(c) 0.75

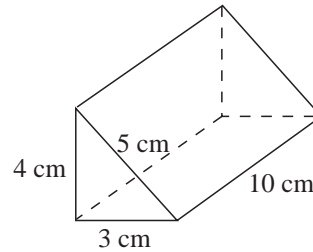
Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

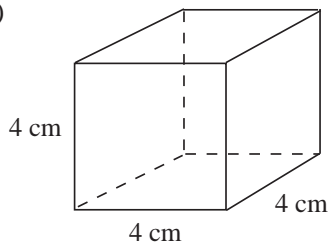
UNIT 7

1. Find the surface area and volume of the prism shown:

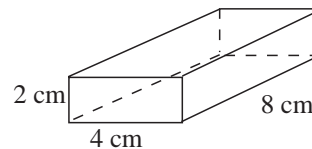


2. Find the surface area and volume of the two cuboids shown below:

(a)

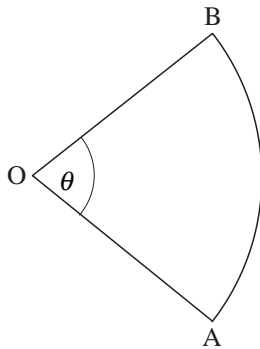


(b)



3. Calculate the volume of a sphere of radius 1.8 cm, giving your answer correct to 1 decimal place.

4.



OAB is a sector of a circle of radius 5 cm.

(a) If $\theta = 30^\circ$, what is the area of the sector?

(b) If the area of the sector is 10 cm^2 , what is the angle θ ?

Answers

1. 1. 132 cm^2 ; 60 cm^3

3. 24.4 cm^3

2. (a) 96 cm^2 ; 64 cm^3

(b) 112 cm^2 , 64 cm^3

4. (a) 6.54 cm^2 (2 d.p.)

(b) 45.8° (1 d.p.)

Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 8

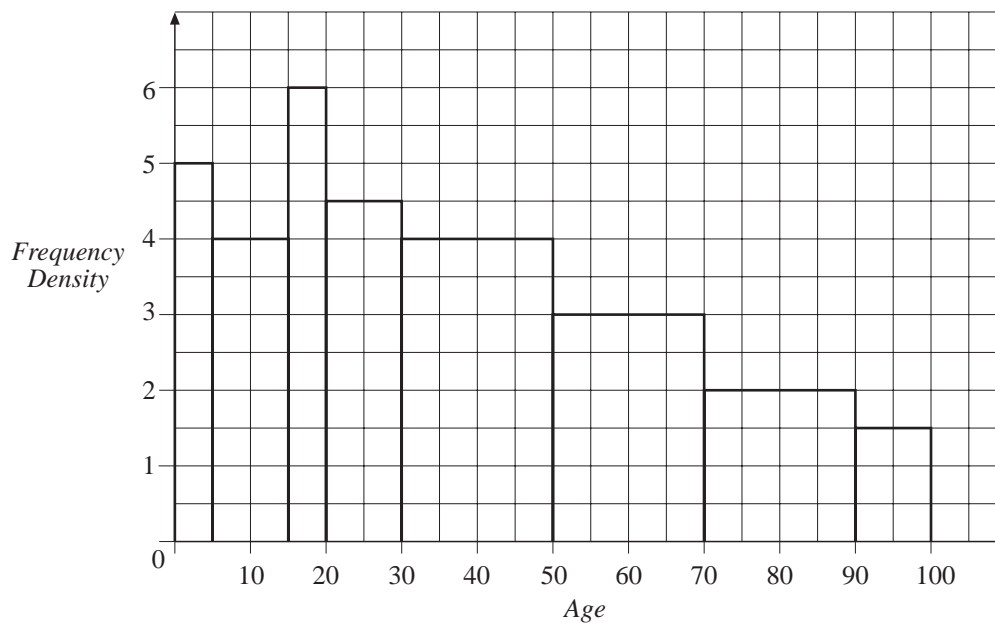
1. The ages, to the nearest year, of the complete population of a village are summarised below:

<i>Age</i>	<i>Number</i>
0 – 4	25
5 – 14	40
15 – 19	30
20 – 29	45
30 – 49	80
50 – 69	60
70 – 89	40
90 – 99	15

Draw a histogram to illustrate these data.

Answers

1.



Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 9

1. The following are marks scored by pupils in a class on a test (out of 20):

9, 17, 18, 12, 14, 13, 12, 15, 6, 13, 12, 10, 14, 13, 17

- (a) Calculate the mean and standard deviation of the scores.

Another class had a mean of 13 and standard deviation of 1.5.

- (b) Compare and contrast the performances of the two classes.

Answers

1. (a) mean = 13, s.d. \approx 3.06
(b) On average, the two classes are the same, but with a much smaller s.d., the second class is much more consistent; i.e. actual scores have less variation about the mean.

Quick Check**Higher Tier**

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 10

1. Solve the quadratic equations by using the formula.

(a) $x^2 + 7x + 5 = 0$

(b) $2x^2 + 3x - 8 = 0$

(c) $3x^2 - 5x - 1 = 0$

2. Show that the quadratic expression

$$x^2 + 6x - 4$$

can be expressed in the form

$$(x + a)^2 + b$$

when a and b are constants. Find the values of a and b , and hence find the solutions to $x^2 + 6x - 4 = 0$, giving your answer in surd form.

3. By completing the square, find the minimum value of the quadratic expression

$$f(x) = x^2 + 2x + 5$$

Answers

1. (a) -0.81 and -6.19 (2 d.p.)

(b) 1.39 and -2.89 (2 d.p.)

(c) 1.85 and -0.18 (2 d.p.)

2. $a = 3$, $b = -13$, $x = -3 \pm \sqrt{13}$

3. $f(x) = (x + 1)^2 + 4$;

minimum value = 4 (at $x = -1$)

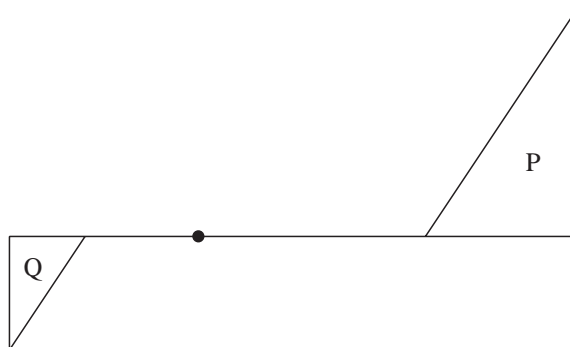
Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 12

1. Triangle P is mapped to triangle Q by a negative enlargement. What is the scale factor?



Answers

1. $-\frac{1}{2}$

Quick Check

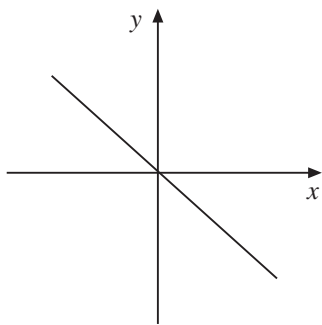
Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

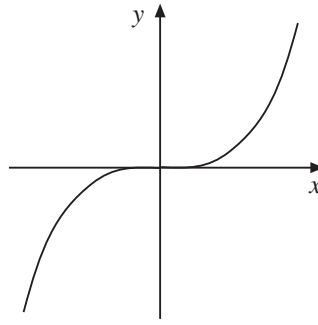
UNIT 13

1. Match each of the following graphs to the appropriate functions given below:

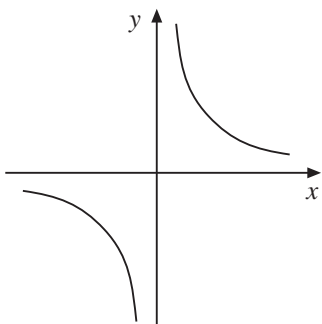
(a)



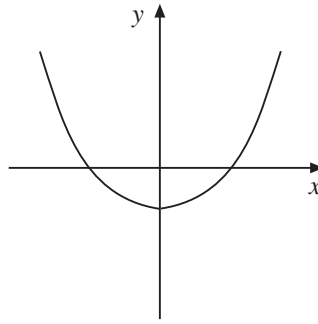
(b)



(c)



(d)



A : $y = x^2 - 1$ B : $y = -x$ C : $y = x^3$ D : $y = \frac{1}{x^2}$ E : $y = x + 1$ F : $y = \frac{1}{x}$

Sketch graphs of the two functions not used.

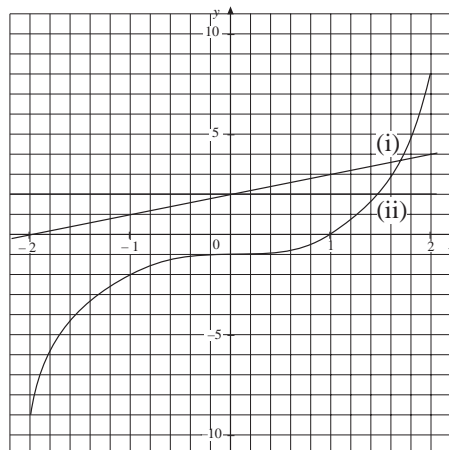
2. Using the same set of axes, draw the graphs of:

(a) $y = x^3 - 1$ (b) $y = x + 2$ for $-2 \leq x \leq 2$.

Hence use the graphs to find approximate solutions to the equations:

(i) $x^3 - x - 3 = 0$

(ii) $x^3 - 3 = 0$



Answers

1. (a) B (b) C (c) F (d) A

2. (i) about 1.65 (intersection of two graphs)

(ii) about 1.45 (intersection of (a) with $y = 2$)

Quick Check**Higher Tier**

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 15

1. If y is proportional to x , copy and complete the table below:

x	1	2	10	20
y	?	10	?	?

2. If y is inversely proportional to x , copy and complete the table below:

x	1	2	10	20
y	?	?	1	?

3. If y is proportional to the square root of x , copy and complete the table below:

x	1	4	9	25
y	?	?	12	?

4. If y is inversely proportional to the square root of x , copy and complete the table below:

x	1	4	9	25
y	?	15	?	?

5. The time of swing of a pendulum, T seconds, is proportional to the square root of its length, L cm. A pendulum of length 25 cm has a time of swing of 1 second.

Find a formula for T in terms of L .

Answers

1.

x	1	2	10	20
y	5	10	50	100

4.

x	1	4	9	25
y	30	15	10	6

2.

x	1	2	10	20
y	10	5	1	0.5

5. $T = 0.2L^{\frac{1}{2}}$

3.

x	1	4	9	25
y	4	8	12	20

Quick Check

Higher Tier

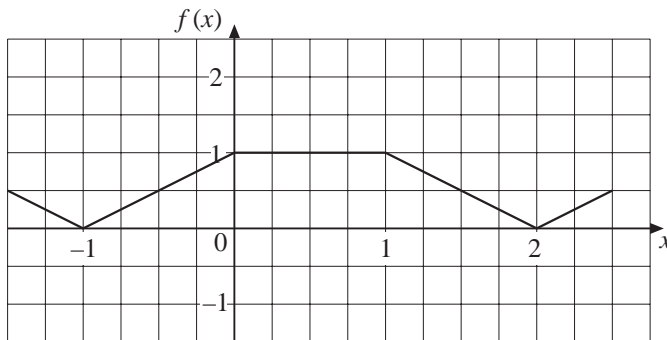
Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 17

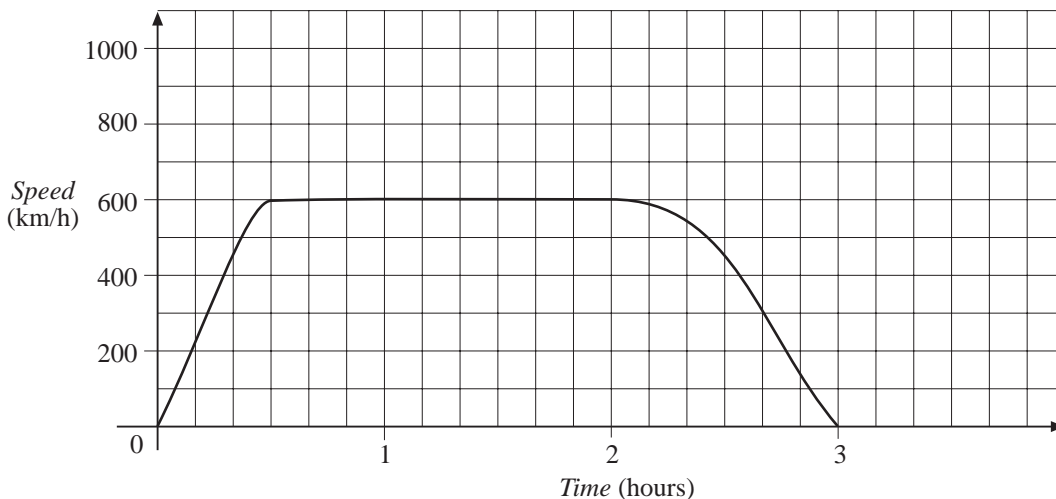
1. The function $y = f(x)$ is sketched opposite.

On suitable axes, draw the graph of:

- (a) $y = f(x) - 1$
- (b) $y = f(x + 1)$
- (c) $y = f\left(\frac{x}{2}\right)$

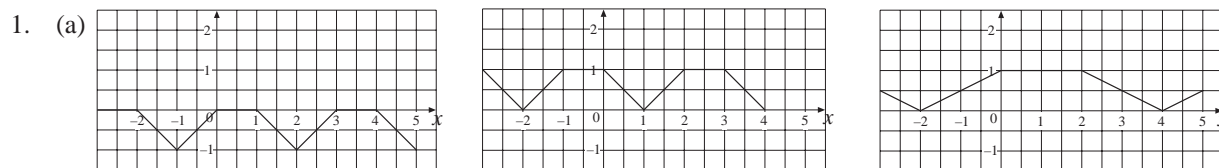


2. The speed-time graph for a plane journey is shown below:



- (a) How long did the journey take?
- (b) Estimate:
 - (i) the maximum acceleration,
 - (ii) the distance travelled.
- (c) Using your answers from (a) and (b) (ii), calculate the average speed.

Answers



2. (a) 3 hours (b) (i) 1350 km/h² (ii) about 1400 km (c) 470 km/h approx.

Quick Check

Higher Tier

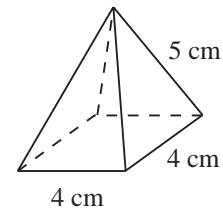
Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 18

1. The diagram shows a square-based pyramid of sides 4 cm, and slant height 5 cm.

Determine:

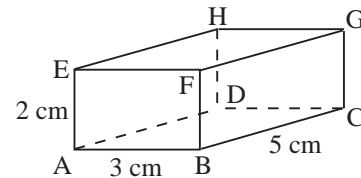
- (a) the vertical height of the pyramid,
 (b) the angle between one of the sides and the base.



2. The diagram shows a cuboid.

Find:

- (a) the length of the diagonal AG,
 (b) the angle between the planes ACGE and BCGF,
 (c) the angle between the line AG and the plane ABCD.



Answers

1. (a) $\sqrt{17} \approx 4.12$ cm (b) 64.1° (1 d.p.) 2. (a) $\sqrt{38} \approx 6.16$ cm (b) 31.0° (2 s.f.)
 (c) 18.9° (1 d.p.)

Quick Check

Higher Tier

Extra Questions to be used in addition to those for the Intermediate Tier

UNIT 19

1. If $\mathbf{a} = \begin{pmatrix} 2 \\ 1 \end{pmatrix}$, $\mathbf{b} = \begin{pmatrix} 1 \\ 3 \end{pmatrix}$, what is:

- (a) $|\mathbf{a}|$
- (b) $\mathbf{a} + \mathbf{b}$
- (c) $\mathbf{a} - 2\mathbf{b}$

Does $|\mathbf{a}| + |\mathbf{b}| = |\mathbf{a} + \mathbf{b}|$?

2. A girl rows her boat at 1.5 m/s across a river of width 30 m. The river flows at 1 m/s.
- (a) Find the direction in which the girl must row if she is to land on the other side, directly opposite the starting point. In this case, find the time it takes to cross the river.
 - (b) If she always rows at 1.5 m/s towards the bank directly opposite, where will she reach the bank, and how long will this take her?

3. OABC is a parallelogram, with $\vec{OA} = \mathbf{a}$, $\vec{OC} = \mathbf{c}$.

X is a point on OA such that $\vec{OX} = \frac{1}{2} \vec{OA}$.

Y is a point on OC such that $\vec{OY} = \frac{1}{2} \vec{OC}$.

- (a) Find vector expressions for \vec{OX} and \vec{OY} in terms of \mathbf{a} and \mathbf{c} .

Z is the midpoint of the line XY.

- (b) Find a vector expression for OZ in terms of \mathbf{a} and \mathbf{c} .
- (c) What two facts can you deduce about the point Z and the line OB?

Answers

1. (a) $\sqrt{5} \approx 2.23$ (b) $\begin{pmatrix} 3 \\ 4 \end{pmatrix}$ (c) $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$; 3. (a) $\vec{OX} = \frac{1}{2}\mathbf{a}$, $\vec{OY} = \frac{1}{2}\mathbf{c}$

No, since $|\mathbf{b}| = \sqrt{10}$, so $|\mathbf{a}| + |\mathbf{b}| = \sqrt{5} + \sqrt{10}$
and $|\mathbf{a} + \mathbf{b}| = 5$.

2. (a) against the flow at angle 48.2° (1 d.p.) to the bank; 26.8 seconds (1 d.p.)
(b) lands 20 secs later, 20 m downstream

(b) $\vec{OZ} = \frac{1}{4}(\mathbf{a} + \mathbf{c})$ (c) Z is on line OB, and

such that $OZ = \frac{1}{3}ZB$