Class	Index Number	Name

BUKIT MERAH SECONDARY SCHOOL

END-OF-YEAR EXAMINATION 2023
SECONDARY 2 EXPRESS

MATHEMATICS **4052/01**

Paper 1 **6 October 2023**

1 hour 15 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 50.

Calculator Model:

For Examiner's Use	
Part A	30
Part B (Algebra Component)	20
Total	50

Part A – Answer **all** questions

1 Calculate $\sqrt[5]{33.5^4 - \frac{2.1}{0.03}}$.

Answer ..... [1]

2 A television screen has sides in the ratio width : height = 4 : 3.
A laptop screen has sides in the ratio width : height = 16 : 9.
An image exactly fills the television screen.
The same image only fills the height of the laptop screen and not the width, as shown in the diagram.

Find the fraction of the laptop screen not covered by the image.
Give your answer in its lowest terms.

Answer ..... [2]

3 The table gives information about a box of books.

	Hardcover	**Paperback**
Fictional	14	12
Non-fictional	6	18

One book is selected at random from the box.

Find, as a fraction in its simplest form, the probability that the book is

(a) a hardcover book,

Answer ..... [1]

(b) a non-fictional book,

Answer ..... [1]

(c) a fictional paperback book.

Answer ..... [1]

4 The table shows some corresponding values of two quantities x and y.

x	1	2	3	4	5
y	6	3	2	1.5	p

(a) Without doing any calculation, explain why x and y are inversely proportional.

Answer .....

..... [1]

(b) Express y in terms of x.

Answer $y =$ ..... [1]

(c) Hence, find the value of p.

Answer $p =$ ..... [1]

5 A map has a scale of 1 : 500 000.

(a) The distance between Singapore and Bali on the map is 332 cm.

Calculate the actual distance, in kilometres, between Singapore and Bali.

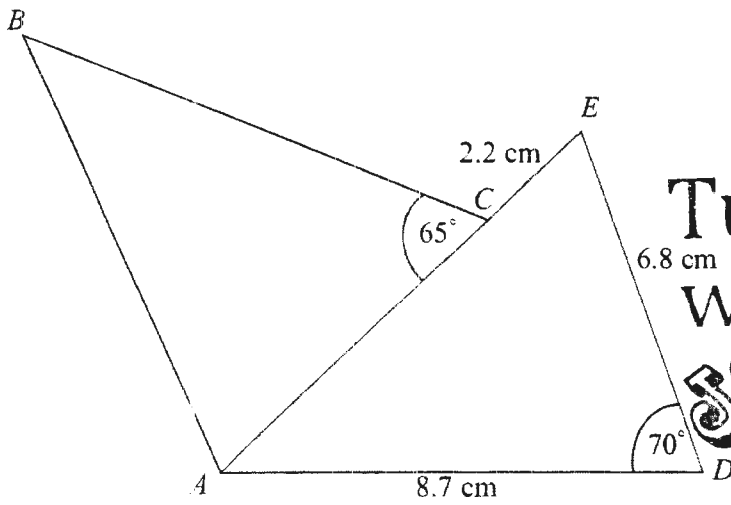
Answer ..... km [2]

(b) The area of Bangkok is 1569 km^2.

Calculate the area, in square centimetres, of Bangkok on the map.

Answer ..... cm^2 [2]

6



Triangle ABC is congruent to triangle DAE.
ACE is a straight line.
Given that $AD = 8.7$ cm, $CE = 2.2$ cm, $DE = 6.8$ cm, angle $ADE = 70°$ and angle $ACB = 65°$.

(a) Find AE.

Answer ..... cm [1]

(b) Find angle EAD.

Answer ..... [1]

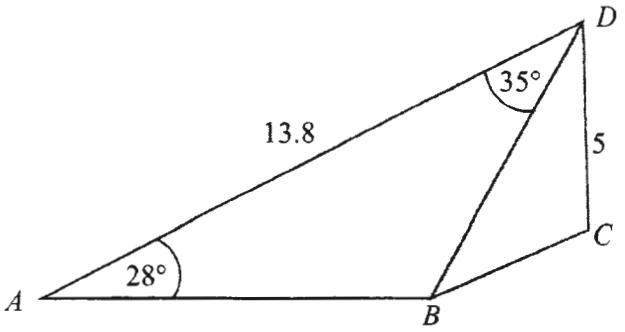
(c) Tom states that AB is parallel to DE.

Show, with calculations, whether you agree with Tom.

Answer I ..... with Tom because .....

..... [2]

7



Triangle ABD is similar to triangle BCD.

Given that angle $BAD = 28°$, angle $BDA = 35°$, $AD = 13.8$ cm and $CD = 5$ cm.

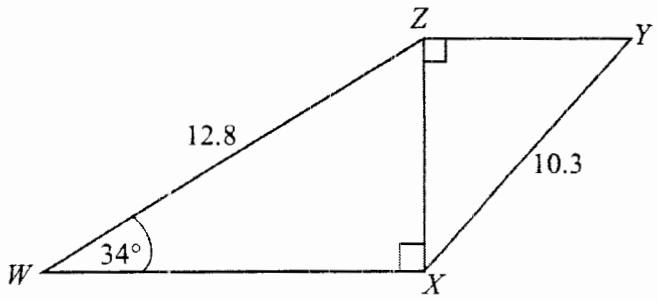
(a) Find angle ABC.

Answer ..... [2]

(b) Find BD.

Answer ..... cm [2]

8



The diagram shows a quadrilateral $WXYZ$.

Angle WXZ = angle YZX = 90°.

Given that WZ = 12.8 cm, XY = 10.3 cm and angle XWZ = 34°.

(a) Find XZ.

Answer ..... cm [2]

(b) Find angle YXZ.

Answer ..... [2]

(c) What is the mathematical name of quadrilateral $WXYZ$?

Answer ..... [1]

9 Jade hires a car during a business trip in France.
She drives a total distance of 738 km.
The car uses fuel at an average rate of 6 litres/100 km.
She pays €1.54 per litre of fuel.
She pays using her credit card and is charged a fee of 1.5% for the currency conversion.
The exchange rate for Singapore dollars and euros is $1 = €0.68.

(a) Calculate the total amount of fuel used by Jade.

Answer ..... *l* [1]

(b) Calculate the total amount, including credit card fee, Jade is charged for fuel.
Give your answer in Singapore dollars correct to the nearest cent.

Answer $ ..... [3]

Part B – Answer **all** questions

10 **(a)** Solve $5x+9>7x-13$.

Answer ..... [1]

(b) State the largest prime number that satisfies your solution in **(a)**.

Answer ..... [1]

11 Show that $(5n-1)^2+4$ is a multiple of 5 for all integer values of n.

Answer

[2]

12 It is given that $y=\dfrac{2x-1}{x-3}$.

(a) Find y when $x=-2$.

Answer $y=$ ..... [1]

(b) Rearrange the formula to make x the subject.

Answer $x=$ ..... [3]

13 Factorise the following expressions completely.

(a) $50 - 2x^2$

Answer ..... [2]

(b) $12x^2 + 4x - 5$

Answer ..... [2]

(c) $5x^2 - 2y - 10x + xy$

Answer ..... [2]

14 The frequency table shows the number of people who entered a supermarket on a particular weekend.

Age	Number of people
$10 \leq x < 20$	p
$20 \leq x < 30$	128
$30 \leq x < 40$	152
$40 \leq x < 50$	q

(a) The total frequency is 400.

Show that $p + q = 120$.

Answer

[1]

(b) The estimated mean age of the visitors is 30.75.

Show that $p + 3q = 252$.

Answer

[2]

(c) Solve the following simultaneous equations.

$$p + q = 120$$
$$p + 3q = 252$$

Answer $p =$ .....

$q =$ ..... [3]

End of Paper

Class	Index Number	Name

BUKIT MERAH SECONDARY SCHOOL

END-OF-YEAR EXAMINATION 2023
SECONDARY 2 EXPRESS

MATHEMATICS **4052/02**

Paper 2 **11 October 2023**

1 hour 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

Write your class, index number and name in the spaces at the top of this page.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.
If working is needed for any question it must be shown with the answer.
Omission of essential working will result in loss of marks.
The use of an approved scientific calculator is expected, where appropriate.
If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.
For π, use either your calculator value or 3.142, unless the question requires the answer in terms of π.

The number of marks is given in brackets [ ] at the end of each question or part question.
The total number of marks for this paper is 60.

Calculator Model:

For Examiner's Use	
Part A	40
Part B (Algebra Component)	20
Total	60

Part A – Answer **all** questions

1 Write the following numbers in order of size, starting with the **smallest**.

$$\left(\frac{2}{5}\right)^2, \quad 15\%, \quad -\frac{3}{5}, \quad 0.18$$

Answer ....., ..., ..., ... [1]

2 A car travels at an average speed of 78.1 km/h for 2.55 hours.

(a) By rounding these numbers correct to 1 significant figure, find an estimate of the distance travelled by the car.

Show the numbers you use.

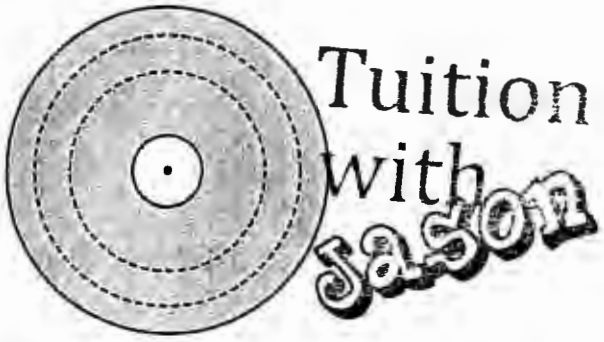
Answer ..... km [1]

(b) Without doing any further calculation, explain why the actual distance travelled by the car is less than the answer to **part (a)**.

Answer .....

..... [1]

3



The diagram shows four circles, all with the same centre.
The radius of the innermost circle is 10 cm and the radius of the outermost circle is 46 cm.
The shaded region is divided into three equal areas by the two dotted circles.

Find the radius of the larger dotted circle.

Answer ..... cm [3]

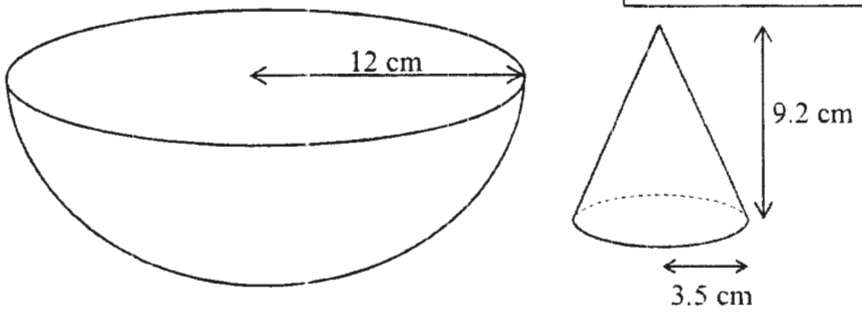
4

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Volume of a sphere = $\frac{4}{3}\pi r^3$



The diagram shows a solid wax candle in the shape of a hemisphere with radius 12 cm and a solid wax candle in the shape of a cone with radius 3.5 cm and a height of 9.2 cm.

(a) Calculate the total surface area of the solid hemisphere.

Answer ..... cm^2 [1]

(b) The solid hemisphere candle is then melted down into a few solid cone candles.

Find the maximum number of solid cone candles that can be formed.

Answer ..... [3]

5 The back-to-back stem-and-leaf diagram shows the masses, in grams, of some apples and oranges in a basket.

Apple						Orange				
		9	8	7	14	0	2	2	6	9
6	2	2	2	0	15	1	1	5	5	5
	5	5	3	2	16	2	3			
				2	17					

Key (Apple)	Key (Orange)
7 | 14 means 147 g	14 | 0 means 140 g

(a) Find the number of fruits in the basket.

Answer ..... [1]

(b) Write down the modal mass of the oranges.

Answer ..... g [1]

(c) Write down the median mass of the apples.

Answer ..... g [1]

(d) Joe stated that the percentage of apples and percentage of oranges that have a mass of more than or equal to 150 g but less than 160 g are the same.

Explain whether you agree with Joe.
Show working to justify your answer.

Answer I ..... with Joe because .....

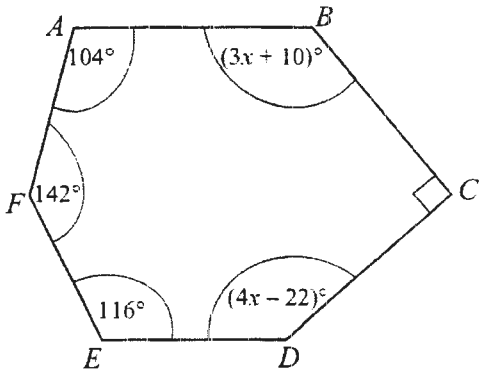
..... [2]

6 **(a)** The interior angle of a regular polygon is five times the exterior angle.

Find the number of sides of the polygon.

Answer ..... [2]

(b)

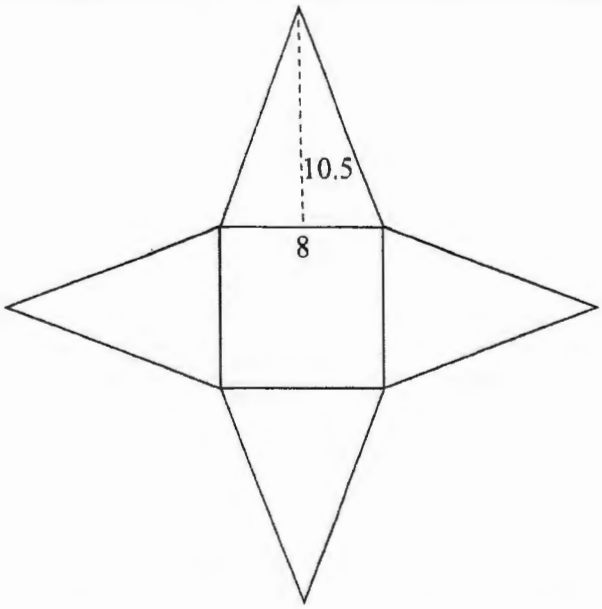


In the hexagon $ABCDEF$, angle $DEF = 116°$, angle $EFA = 142°$, angle $FAB = 104°$ and angle $DCB = 90°$.

Calculate x.

Answer $x =$ ..... [3]

7



The diagram shows the net of a pyramid. It consists of a square and 4 triangles.
The length of each side of the square is 8 cm. The height of the triangle is 10.5 cm.

(a) Show that the total surface area of the pyramid is 232 cm^2.

Answer

[2]

(b) Find the volume of the pyramid.

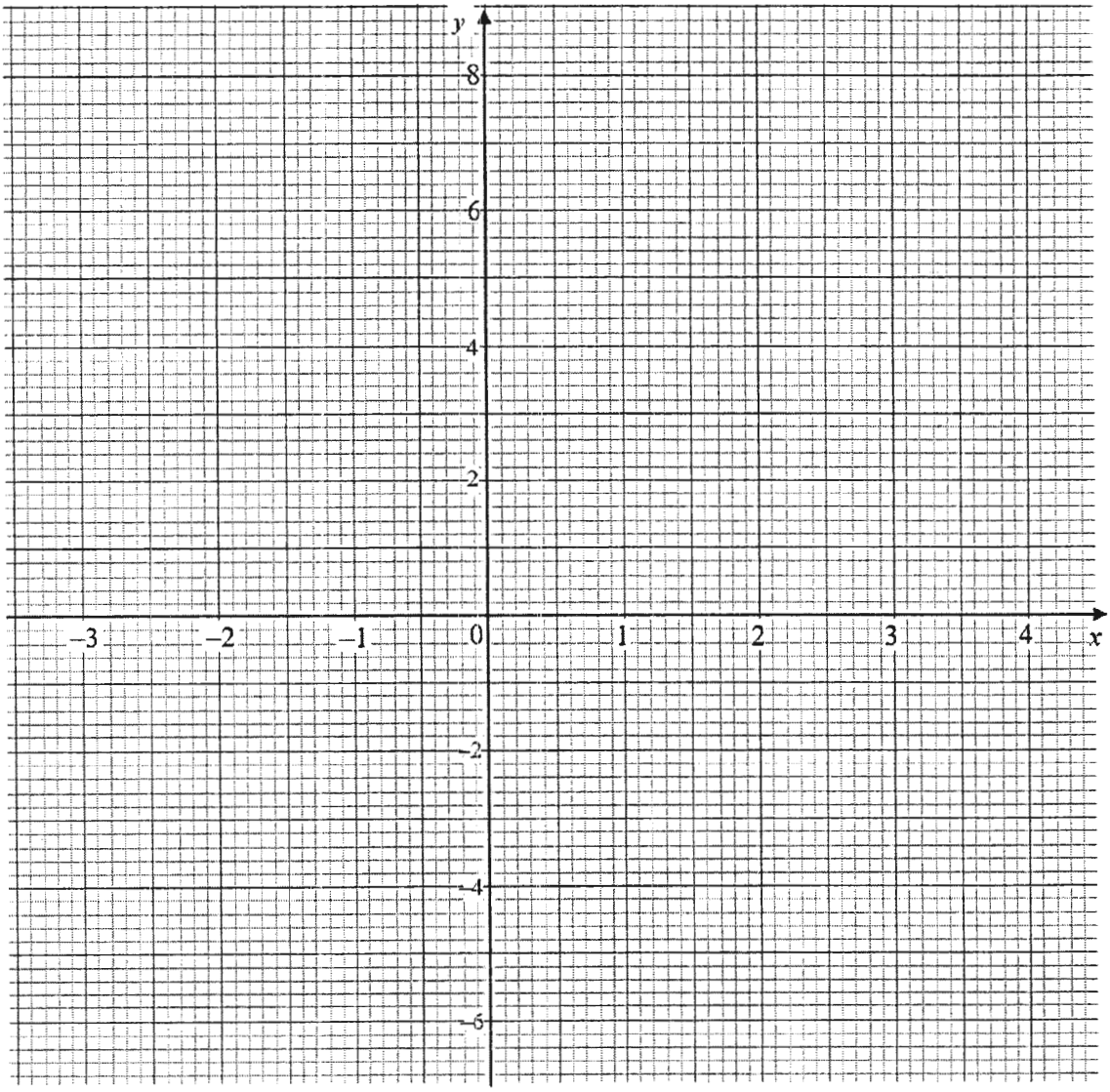
Answer ..... cm^3 [3]

8 **(a)** Complete the table of values for $y = -x^2 + x + 6$.

x	−3	−2	−1	0	1	2	3	4
y		0	4	6	6	4	0	−6

[1]

(b) On the grid, draw the graph of $y = -x^2 + x + 6$ for $-3 \leq x \leq 4$.



[3]

(c) Use your graph to find

(i) the coordinates of the turning point,

Answer (....., ...) [1]

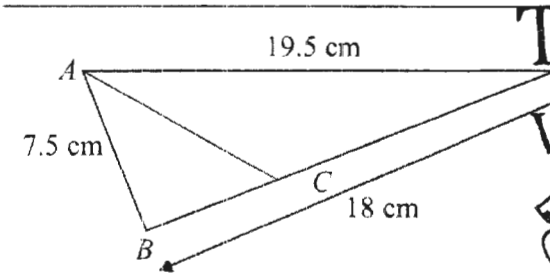
(ii) the equation of the line of symmetry,

Answer ..... [1]

(iii) the values of x when $y = 2$.

Answer $x =$ ..... or ..... [1]

9



In the diagram, BCD is a straight line.

Given that $AB = 7.5$ cm, $BD = 18$ cm, $AD = 19.5$ cm and $BC = \frac{1}{3}BD$.

(a) Show that triangle ABD is a right-angled triangle.

Answer

[2]

(b) Find the length of AC.

Answer ..... cm [2]

(c) Find the shortest distance from the point B to the line AD.

Answer ..... cm [2]

(d) Expressing your answers as fractions in the simplest form, find

(i) $\sin \angle ADC$,

Answer ..... [1]

(ii) $\tan \angle ACB$.

Answer ..... [1]

Part B – Answer **all** questions

10 Simplify the following expressions.

(a) $\dfrac{6x^2y}{12xy^3}$

Answer ..... [1]

(b) $\dfrac{5x^2-10x}{8x^2-13x-6}$

Answer ..... [2]

11 Solve $\dfrac{3x-1}{5}+\dfrac{2x-3}{7}=2$.

Answer $x =$ ..... [2]

12 Express the following as a single fraction in its simplest form.

(a) $\dfrac{5}{x+2}-\dfrac{2}{2x+1}$

Answer ..... [2]

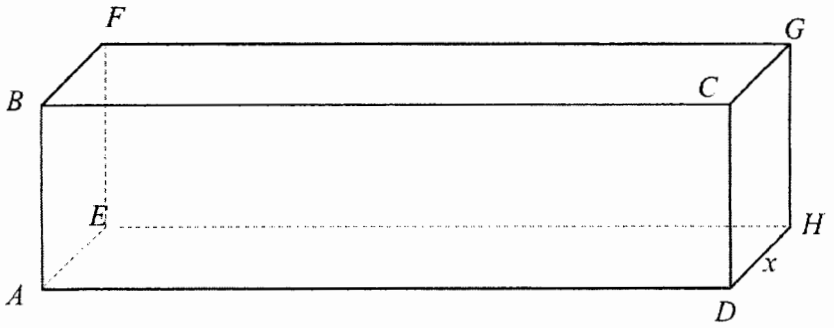
(b) $\dfrac{6x-5}{(x-7)(3x+2)}+\dfrac{2}{7-x}$

Answer ..... [2]

(c) $\dfrac{x^2+3x}{x^2-9}\div\dfrac{x-9}{2x-6}$

Answer ..... [3]

13



The diagram shows a cuboid with width x cm.
The width of the cuboid is 2.5 cm less than its height.
The length of the cuboid is four times of its height.

(a) Write down an expression, in terms of x, for the length of the cuboid.

Answer ..... [1]

(b) The total surface area of the cuboid is 325 cm^2.

Form an equation, in terms of x, to represent this information and show that it simplifies to

$$18x^2 + 65x - 275 = 0 .$$

Answer

[3]

(c) Solve the equation $18x^2 + 65x - 275 = 0$.

Answer $x =$ ..... or ..... [2]

(d) Find the volume of the cuboid.

Answer ..... cm^3 [2]

End of Paper

Part A – Answer **all** questions

BMSS SEC 2E
MATHEMATICS
EOY PAPER 1
MARK SCHEME

1 Calculate $\sqrt[5]{33.5^4 - \frac{2.1}{0.03}}$.

16.6 (3sf) **B1**

Answer ..... [1]

2 A television screen has sides in the ratio width : height = 4 : 3.
A laptop screen has sides in the ratio width : height = 16 : 9.
An image exactly fills the television screen.
The same image only fills the height of the laptop screen and not the width, as shown in the diagram.

Find the fraction of the laptop screen not covered by the image.
Give your answer in its lowest terms.

W	:	H
4	:	3
12	:	9

M1

Fraction of the laptop screen covered by the image = $\frac{12}{16} = \frac{3}{4}$

Fraction of the laptop screen not covered by the image = $\frac{1}{4}$ **A1**

Answer ..... [2]

3 The table gives information about a box of books.

	Hardcover	Paperback
Fictional	14	12
Non-fictional	6	18

One book is selected at random from the box.

Find, as a fraction in its simplest form, the probability that the book is

(a) a hardcover book,

$$\text{P (hardcover)} = \frac{20}{50} = \frac{2}{5} \quad \textbf{B1}$$

Answer ..... [1]

(b) a non-fictional book,

$$\text{P (non-fictional)} = \frac{24}{50} = \frac{12}{25} \quad \textbf{B1}$$

Answer ..... [1]

(c) a fictional paperback book.

$$\text{P (fictional paperback)} = \frac{12}{50} = \frac{6}{25} \quad \textbf{B1}$$

Answer ..... [1]

4 The table shows some corresponding values of two quantities x and y.

x	1	2	3	4	5
y	6	3	2	1.5	p

(a) Without doing any calculation, explain why x and y are inversely proportional.

Answer When the value x increases, the value of y decreases. **B1** [1]

(b) Express y in terms of x.

$$y = \frac{6}{x} \quad \textbf{B1}$$

Answer $y =$ ..... [1]

(c) Hence, find the value of p.

$$p = \frac{6}{5} = 1.2 \quad \textbf{B1, allow ecf}$$

Answer $p =$ ..... [1]

5 A map has a scale of 1 : 500 000 .

(a) The distance between Singapore and Bali on the map is 332 cm.

Calculate the actual distance, in kilometres, between Singapore and Bali.

1 : 500 000 = 1 cm : 5 km **M1, change to km**
Actual distance = 5(332)
= 1660 km **A1**

Answer ..... km [2]

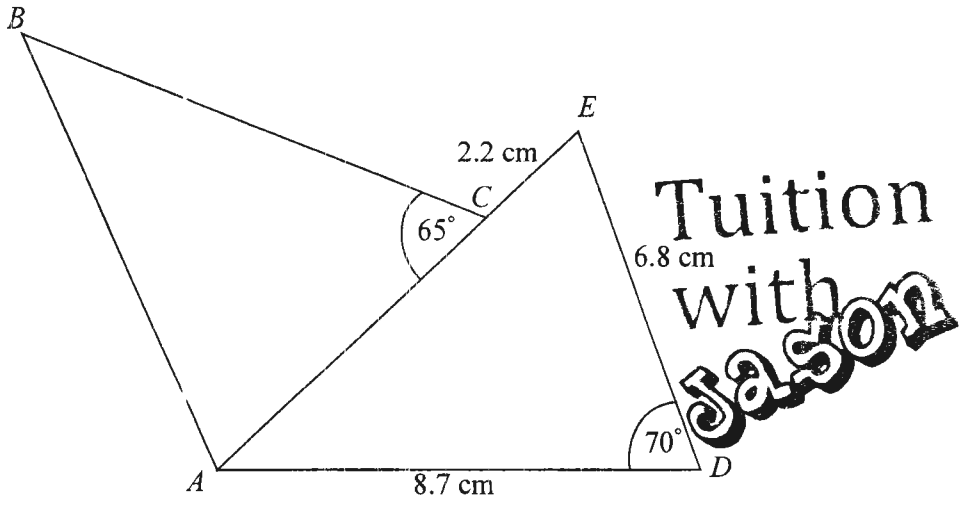
(b) The area of Bangkok is 1569 km^2.

Calculate the area, in square centimetres, of Bangkok on the map.

Area scale 1 cm^2 : 25 km^2 **M1, area scale, allow ecf**
Area on map = $\frac{1569}{25}$
= 62.76 cm^2 **A1, allow ecf**

Answer ..... cm^2 [2]

6



Triangle ABC is congruent to triangle DAE.
ACE is a straight line.
Given that $AD = 8.7$ cm, $CE = 2.2$ cm, $DE = 6.8$ cm, angle $ADE = 70°$ and angle $ACB = 65°$.

(a) Find AE.

$AE = AC + CE$
$= DE + CE$
$= 6.8 + 2.2$
$= 9$ cm **B1**

Answer ..... cm [1]

(b) Find angle EAD.

$\angle EAD = 180 - 65 - 70$
$= 45°$ **B1**

Answer ..... [1]

(c) Tom states that AB is parallel to DE.

Show with calculations, whether you agree with Tom.

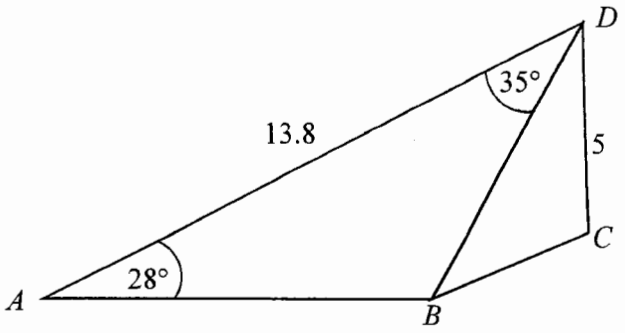
Answer

$\angle BAD + \angle ADE = 70 + 45 + 70 = 185°$ **M1, allow ecf**

I **do not agree** with Tom because $\angle BAD$ and $\angle ADE$ do not add up to 180°, they are not a pair of **interior angles**. Hence AB is **not** parallel to DE. **A1, allow ecf (must name angles and property)**

[2]

7



Triangle ABD is similar to triangle BCD.

Given that angle $BAD = 28°$, angle $BDA = 35°$, $AD = 13.8$ cm and $CD = 5$ cm.

(a) Find angle ABC.

$\angle ABD = 180 - 28 - 35 = 117°$ **M1**

$\angle ABC = 117 + 28 = 145°$ **A1**

Answer ..... [2]

(b) Find BD.

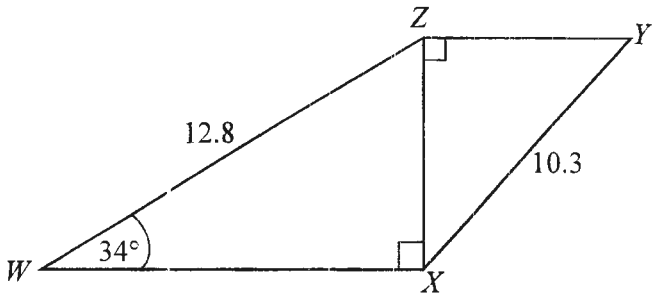
$\frac{BD}{13.8} = \frac{5}{BD}$ **M1**

$BD^2 = 69$

$BD = 8.31$ cm (3sf) **A1**

Answer ..... cm [2]

8



The diagram shows a quadrilateral $WXYZ$.

Angle WXZ = angle $YZX = 90°$.

Given that $WZ = 12.8$ cm, $XY = 10.3$ cm and angle $XWZ = 34°$.

(a) Find XZ.

$$\sin 34° = \frac{XZ}{12.8} \quad \textbf{M1}$$

$$XZ = 12.8 \sin 34°$$

$$= 7.16 \text{ cm (3sf)} \quad \textbf{A1}$$

Answer ..... cm [2]

(b) Find angle YXZ.

$$\cos \angle YXZ = \frac{7.15766}{10.3} \quad \textbf{M1, allow ecf}$$

$$\angle YXZ = \cos^{-1}\left(\frac{7.15766}{10.3}\right)$$

$$= 46.0° \quad \textbf{A1, allow ecf}$$

Answer ..... [2]

(c) What is the mathematical name of quadrilateral $WXYZ$?

Trapezium **B1**

Answer ..... [1]

9 Jade hires a car during a business trip in France.
She drives a total distance of 738 km.
The car uses fuel at an average rate of 6 litres/100 km.
She pays €1.54 per litre of fuel.
She pays using her credit card and is charged a fee of 1.5% for the currency conversion.
The exchange rate for Singapore dollars and euros is \$1 = €0.68.

(a) Calculate the total amount of fuel used by Jade.

Amount of litres of fuel = $\frac{738}{100} \times 6 = 44.28\ l$ **B1**

Answer ..... *l* [1]

(b) Calculate the total amount, including credit card fee, Jade is charged for fuel.
Give your answer in Singapore dollars correct to the nearest cent.

Total cost of fuel = $1.54(44.28) = 68.1912$ **M1**

Total cost in euros including currency conversion = $\frac{101.5}{100} \times 68.1912 = 69.214068$ **M1**

Amount in SGD = $\frac{69.214068}{0.68}$

= \$101.79 (nearest cent) **A1**

Answer \$ ..... [3]

Part B – Answer **all** questions

10 **(a)** Solve $5x+9>7x-13$.

$x<11$ **B1**

Answer ..... [1]

(b) State the largest prime number that satisfies your solution in **(a)**.

7 **B1, allow ecf if equality is $x <$ number**

Answer ..... [1]

11 Show that $(5n-1)^2+4$ is a multiple of 5 for all integer values of n.

Answer

$(5n-1)^2+4=25n^2-10n+5$ **M1, expand correctly**

$=5(5n^2-2n+1)$ **A1, factorise 5**

Hence, $(5n-1)^2+4$ that is a multiple of 5 for all integer values of n.

[2]

12 It is given that $y=\dfrac{2x-1}{x-3}$.

(a) Find y when $x=-2$.

$y=1$ **B1**

Answer $y=$ ..... [1]

(b) Rearrange the formula to make x the subject.

$y(x-3)=2x-1$ **M1, remove denominator**

$xy-3y=2x-1$

$xy-2x=3y-1$ **M1, make all x terms on one side**

$x(y-2)=3y-1$

$x=\dfrac{3y-1}{y-2}$ **A1**

Answer $x=$ ..... [3]

13 Factorise the following expressions completely.

(a) $50-2x^2$

$$50-2x^2 = 2(25-x^2) \quad \textbf{M1}$$
$$= 2(5+x)(5-x) \quad \textbf{A1}$$

Answer ..... [2]

(b) $12x^2+4x-5$

$$(2x-1)(6x+5) \quad \textbf{B1, B1}$$

Answer ..... [2]

(c) $5x^2-2y-10x+xy$

$$5x^2-2y-10x+xy = 5x^2-10x+xy-2y$$
$$= 5x(x-2)+y(x-2) \quad \textbf{M1}$$
$$= (5x+y)(x-2) \quad \textbf{A1}$$

Answer ..... [2]

14 The frequency table shows the number of people who entered a supermarket on a particular weekend.

Age	Number of people
$10 \le x < 20$	p
$20 \le x < 30$	128
$30 \le x < 40$	152
$40 \le x < 50$	q

(a) The total frequency is 400

Show that $p + q = 120$.

Answer

$p + 128 + 152 + q = 400$
$p + q = 400 - 128 - 152$ **B1**
$p + q = 120$

[1]

(b) The estimated mean age of the visitors is 30.75.

Show that $p + 3q = 252$.

Answer

$15p + 25(128) + 35(152) + 45q = 30.75(400)$ **M1**
$15p + 3200 + 5320 + 45q = 12300$
$15p + 45q = 3780$ **A1**
$p + 3q = 252$ (shown)

[2]

(c) Solve the following simultaneous equations.

$p + q = 120$
$p + 3q = 252$
$2q = 132$ **M1, correct substitution/elimination**
$q = 66$ **A1**
$p = 54$ **A1**

Answer $p =$ .....

$q =$ ..... [3]

End of Paper

Part A – Answer **all** questions

BMSS SEC 2E
MATHEMATICS
EOY PAPER 2
MARK SCHEME

1 Write the following numbers in order of size, starting with the **smallest**.

$$\left(\frac{2}{5}\right)^2, \quad 15\%, \quad -\frac{3}{5}, \quad 0.18$$

$$-\frac{3}{5}, 15\%, \left(\frac{2}{5}\right)^2, 0.18 \quad \textbf{B1}$$

Answer ....., ..., ..., ... [1]

2 A car travels at an average speed of 78.1 km/h for 2.55 hours.

(a) By rounding these numbers correct to 1 significant figure, find an estimate of the distance travelled by the car.

Show the numbers you use.

$$\text{Dist} = 80 \times 3$$
$$= 240 \text{ km} \quad \textbf{B1}$$

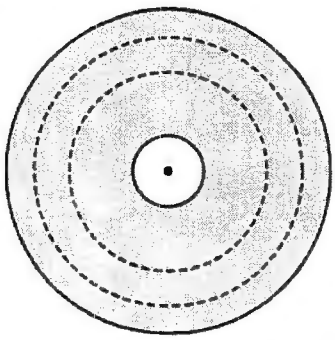
Answer ..... km [1]

(b) Without doing any further calculation, explain why the actual distance travelled by the car is less than the answer to **part (a)**.

Answer

The **actual values of speed and time are smaller** than the values that are used in part (a), hence the actual distance travelled by the car is less than the answer to part (a). [1]
B1 must mention both speed and time

3



The diagram shows four circles, all with the same centre.
The radius of the innermost circle is 10 cm and the radius of the outermost circle is 46 cm.
The shaded region is divided into three equal areas by the two dotted circles.

Find the radius of the larger dotted circle.

Area of shaded region = $\pi(46)^2 - \pi(10)^2$

$= 2016\pi$

Area of one shaded region divided by the dotted line = $\frac{2016\pi}{3}$ **M1**

$= 672\pi$

$672\pi + 672\pi + 10^2\pi = \pi r^2$ **M1**

$r = \sqrt{1444}$

$= 38$ cm **A1**

Answer ..... cm [3]

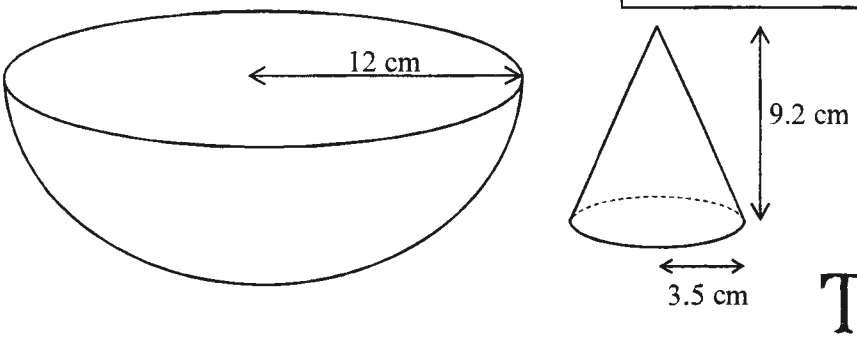
4

Curved surface area of a cone = πrl

Surface area of a sphere = $4\pi r^2$

Volume of a cone = $\frac{1}{3}\pi r^2 h$

Volume of a sphere = $\frac{4}{3}\pi r^3$



The diagram shows a solid wax candle in the shape of a hemisphere with radius 12 cm and a solid wax candle in the shape of a cone with radius 3.5 cm and a height of 9.2 cm.

(a) Calculate the total surface area of the solid hemisphere.

Total surface area = $2\pi(12)^2 + \pi(12)^2$

= 1360 cm^2 (3sf) **B1**

Answer ..... cm^2 [1]

(b) The solid hemisphere candle is then melted down into a few solid cone candles.

Find the maximum number of solid cone candles that can be formed.

Volume of hemisphere = $\frac{2}{3}\pi(12)^3 = 3619.114$ **M1**

Volume of cone = $\frac{1}{3}\pi(3.5)^2(9.2) = 118.019$ **M1**

Number of solid cone candles = $\frac{3619.114}{118.019} = 30.6654$

Maximum number of solid cone candles = 30 **A1**

Answer ..... [3]

5 The back-to-back stem-and-leaf diagram shows the masses, in grams, of some apples and oranges in a basket.

Apple						Orange				
		9	8	7	14	0	2	2	6	9
6	2	2	2	0	15	1	1	5	5	5
	5	5	3	2	16	2	3			
				2	17					

Key (Apple)	Key (Orange)
7 | 14 means 147 g	14 | 0 means 140 g

(a) Find the number of fruits in the basket.

25 **B1**

Answer ..... [1]

(b) Write down the modal mass of the oranges.

155 g **B1**

Answer ..... g [1]

(c) Write down the median mass of the apples.

152 g **B1**

Answer ..... g [1]

(d) Joe stated that the percentage of apples and percentage of oranges that have a mass of more than or equal to 150 g but less than 160 g are the same.

Explain whether you agree with Joe.
Show working to justify your answer.

Percentage of apples $= \frac{5}{13} \times 100$
$= 38.5\%$ (3sf)

Percentage of oranges $= \frac{5}{12} \times 100$
$= 41.7\%$ (3sf)

M1 for both percentages

Answer I **disagree** with Joe because the **number of apples and oranges are different.** **A1**

[2]

6 **(a)** The interior angle of a regular polygon is five times the exterior angle.

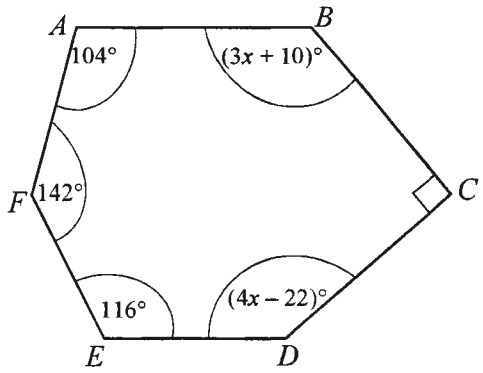
Find the number of sides of the polygon.

$$1 \text{ ext angle} = \frac{180}{6} = 30° \quad \textbf{M1}$$

$$n = \frac{360}{30} = 12 \quad \textbf{A1}$$

Answer ..... [2]

(b)



In the hexagon $ABCDEF$, angle $DEF = 116°$, angle $EFA = 142°$, angle $FAB = 104°$ and angle $DCB = 90°$.

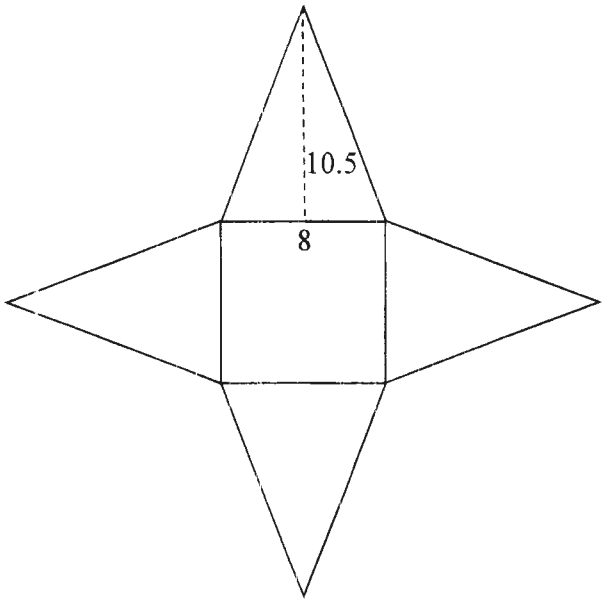
Calculate x.

$116+142+104+3x+10+90+4x-22=180(6-2)$ **M1 for 180(6-2), M1 for adding angles correctly**

$$7x+440=720$$
$$7x=280$$
$$x=40 \quad \textbf{A1}$$

Answer $x =$ ..... [3]

7



The diagram shows the net of a pyramid. It consists of a square and 4 triangles.
The length of each side of the square is 8 cm. The height of the triangle is 10.5 cm.

(a) Show that the total surface area of the pyramid is 232 cm^2.

Answer

Area of square = 8(8) = 64

Area of 4 triangles = $4 \times \frac{1}{2} \times 8 \times 10.5 = 168$ } **M1 for either one**

Total surface area = 64 + 168 = 232 cm^2 **A1**

[2]

(b) Find the volume of the pyramid.

Vertical height of pyramid = $\sqrt{10.5^2 - 4^2}$

= 9.70824 **M1**

Volume = $\frac{1}{3} \times 8 \times 8 \times 9.70824$ **M1**

= 207 cm^3 **A1**

Answer ..... cm^3 [3]

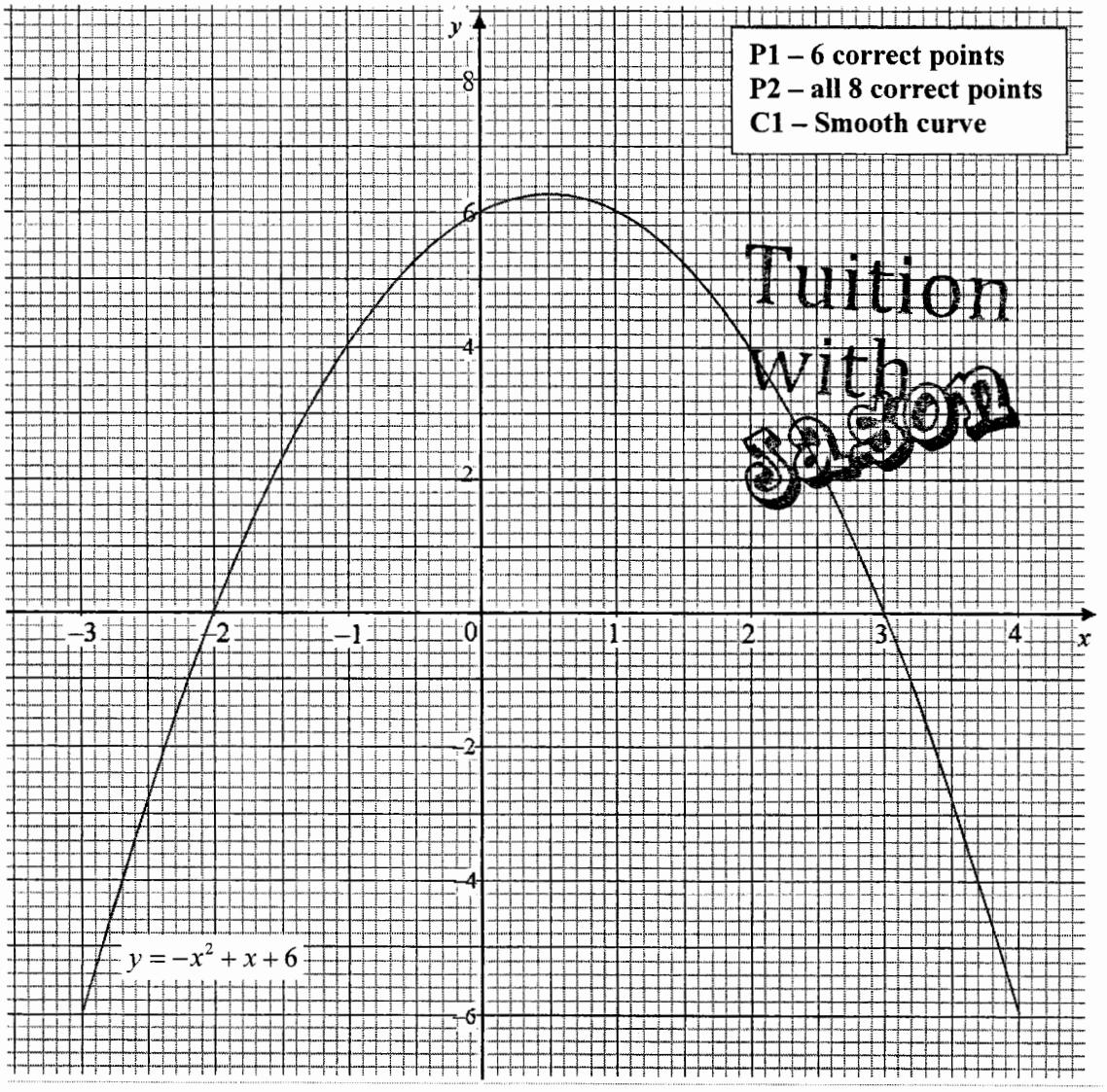
8 **(a)** Complete the table of values for $y = -x^2 + x + 6$.

B1

x	−3	−2	−1	0	1	2	3	4
y	**−6**	0	4	6	6	4	0	−6

[1]

(b) On the grid, draw the graph of $y = -x^2 + x + 6$ for $-3 \leq x \leq 4$.



[3]

(c) Use your graph to find

(i) the coordinates of the turning point,

(0.5, 6.3) **B1**

Answer (....., ...) [1]

(ii) the equation of the line of symmetry,

$x = 0.5$ **B1**

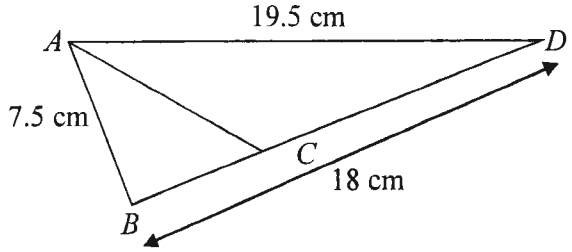
Answer ..... [1]

(iii) the values of x when $y = 2$.

$x = 2.55 \pm 0.1$ or -1.55 ± 0.1 **B1**

Answer $x =$ ..... or ..... [1]

9



In the diagram, BCD is a straight line.

Given that $AB = 7.5$ cm, $BD = 18$ cm, $AD = 19.5$ cm and $BC = \frac{1}{3}BD$.

(a) Show that triangle ABD is a right-angled triangle.

Answer

$7.5^2 + 18^2 = 380.25$
$19.5^2 = 380.25$ } **M1**

Since $AB^2 + BD^2 = AD^2$ (or $7.5^2 + 18^2 = 19.5^2$), **by the converse of Pythagoras' theorem,** ΔABD is a right-angled triangle. **A1**

[2]

(b) Find the length of AC.

$BC = 6$ cm
$AC = \sqrt{6^2 + 7.5^2}$ **M1**
$= 9.60$ cm (3sf) **A1**

Answer ..... cm [2]

(c) Find the shortest distance from the point B to the line AD.

$\frac{1}{2} \times x \times 19.5 = \frac{1}{2} \times 7.5 \times 18$ **M1**
$x = 6.92$ cm (3sf) **A1**

Answer ..... cm [2]

(d) Expressing your answers as fractions in the simplest form, find

(i) $\sin \angle ADC$,

$\sin \angle ADC = \frac{7.5}{19.5} = \frac{5}{13}$ **B1**

Answer ..... [1]

(ii) $\tan \angle ACB$.

$\tan \angle ACB = \frac{7.5}{6} = \frac{5}{4}$ **B1**

Answer ..... [1]

Part B – Answer **all** questions

10 Simplify the following expressions.

(a) $\dfrac{6x^2y}{12xy^3}$

$\dfrac{x}{2y^2}$ **B1**

Answer ..... [1]

(b) $\dfrac{5x^2-10x}{8x^2-13x-6}$

$\dfrac{5x(x-2)}{(x-2)(8x+3)}$ **M1, for factorising either numerator or denominator**

$= \dfrac{5x}{8x+3}$ **A1**

Answer ..... [2]

11 Solve $\dfrac{3x-1}{5}+\dfrac{2x-3}{7}=2$.

$7(3x-1)+5(2x-3)=70$ **M1**

$21x-7+10x-15=70$

$31x=92$

$x=2\dfrac{30}{31}$ (or 2.97) **A1**

Answer $x =$ ..... [2]

12 Express the following as a single fraction in its simplest form.

(a) $\dfrac{5}{x+2}-\dfrac{2}{2x+1}$

$$\frac{5(2x+1)-2(x+2)}{(x+2)(2x+1)}$$ **M1, a single fraction**

$$=\frac{10x+5-2x-4}{(x+2)(2x+1)}$$

$$=\frac{8x+1}{(x+2)(2x+1)}$$ **A1**

Answer ..... [2]

(b) $\dfrac{6x-5}{(x-7)(3x+2)}+\dfrac{2}{7-x}$

$$\frac{6x-5-2(3x+2)}{(x-7)(3x+2)}$$ **M1, for changing sign and one fraction**

$$=\frac{6x-5-6x-4}{(x-7)(3x+2)}$$

$$=\frac{-9}{(x-7)(3x+2)}$$ **A1**

Answer ..... [2]

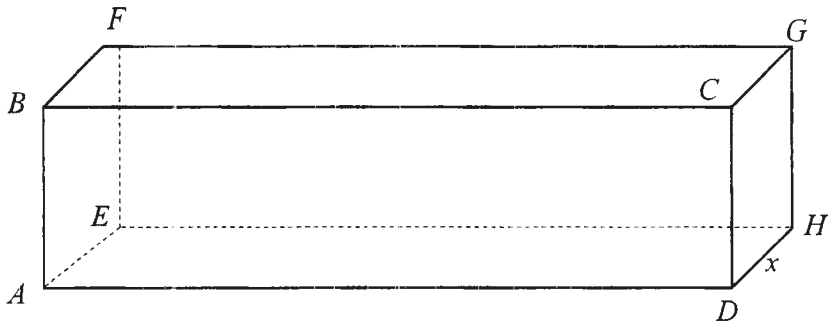
(c) $\dfrac{x^2+3x}{x^2-9}\div\dfrac{x-9}{2x-6}$

$$\frac{x(x+3)}{(x+3)(x-3)}\times\frac{2(x-3)}{x-9}$$ **M1 for $(x+3)(x-3)$, M1 for either $x(x+3)$ or $2(x-3)$**

$$=\frac{2x}{x-9}$$ **A1**

Answer ..... [3]

13



The diagram shows a cuboid with width x cm.
The width of the cuboid is 2.5 cm less than its height.
The length of the cuboid is four times of its height.

(a) Write down an expression, in terms of x, for the length of the cuboid.

Length of the cuboid = $4(x + 2.5)$ cm **B1, or $4x + 10$**

Answer ..... [1]

(b) The total surface area of the cuboid is 325 cm^2.

Form an equation, in terms of x, to represent this information and show that it simplifies to

$$18x^2 + 65x - 275 = 0 .$$

Answer

$2x(x+2.5)+2x(4x+10)+2(x+2.5)(4x+10)=325$ **M1 for 2 correct length × length**

$2x^2+5x+8x^2+20x+2(4x^2+10x+10x+25)=325$ **M1 for expanding** $(x+2.5)(4x+10)$

$2x^2+5x+8x^2+20x+8x^2+40x+50-325=0$
$18x^2+65x-275=0$ (shown) } **A1**

[3]

(c) Solve the equation $18x^2 + 65x - 275 = 0$.

$(2x-5)(9x+55)=0$ **M1**

$x=\frac{5}{2}$ or $x=-\frac{55}{9}$ **A1**

Answer $x =$ ..... or ..... [2]

(d) Find the volume of the cuboid.

Width = 5 cm
Length = 20 cm
Volume = 2.5(5)(20) **M1**
= 250 cm^3 **A1**

Answer ..... cm^3 [2]