edexcel

GCSE Mathematics Practice Tests: Set 3

Paper 2H (Calculator)

Time: 1 hour 30 minutes

You should have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, calculator.

LJH Worked Solutions

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- **Calculators may be used.**
- Diagrams are NOT accurately drawn, unless otherwise indicated.
- You must **show all your working out.**

Information

- The total mark for this paper is 80
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Try to answer every question.
- Check your answers if you have time at the end.

ALWAYS LEARNING PEARSON

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1.

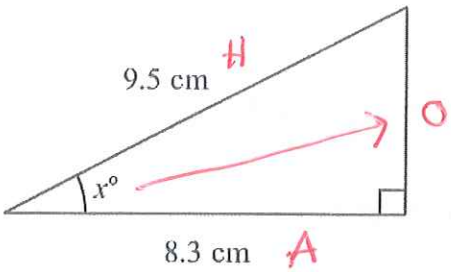
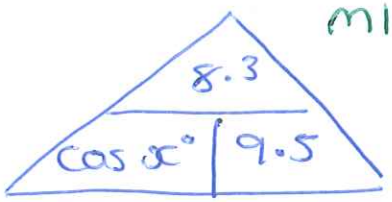


Diagram **NOT** accurately drawn

Work out the value of x.
Give your answer correct to 1 decimal place.



M1 use of cos

$\cos x = \frac{8.3}{9.5}$

M1

$x = \cos^{-1}\left(\frac{8.3}{9.5}\right)$

$= 29.110367$

A1

$x =$ 29.1° (1dp)

(Total 3 marks)

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2. On July 1st 2004, Jack invested £2000 at 5% per annum compound interest.

Work out the value of Jack's investment on July 1st 2006

July 1st 2004 £2000

5% of £2000 = £100

£2000 + £100 = £2100 M1

July 1st 2005 £2100

5% of £2100 = £105 M1

£2100 + £105 = £2205

July 1st 2006 £2205

Quick method

£2000 × 1.05^2 = £2205

M2

£ 2205 A1

(Total 3 marks)

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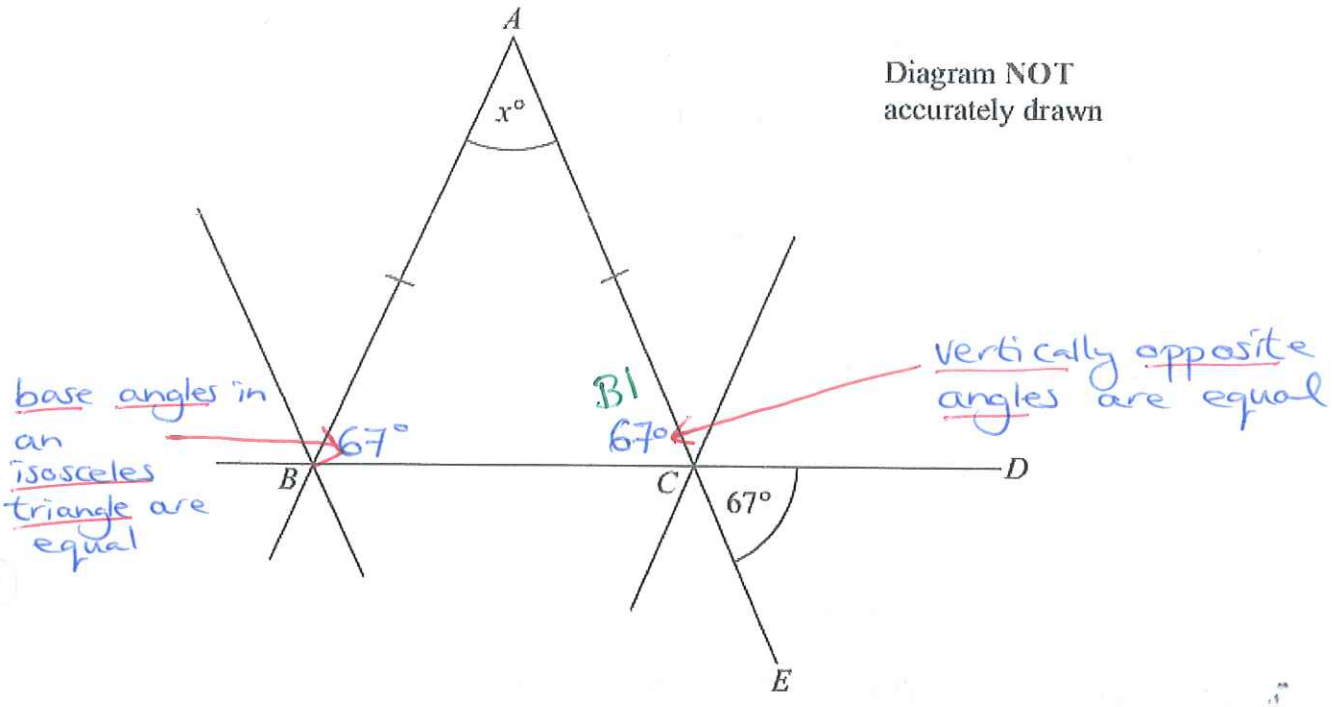
3. The diagram shows part of the design of a stained glass window.



ABC is an isosceles triangle. *BCD* and *ACE* are straight lines. Angle *DCE* = 67°.

Work out the size of the angle marked *x*°. Give reasons for your answer.

$67° + 67° = 134°$

$180° - 134° = 46°$

m1

$x = 46°$

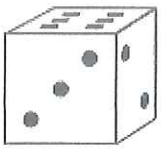
A1

angles in a triangle add up to 180°

C1 all reasons given

(Total 4 marks)

4. Naomi is playing a board game.
She must throw two fair dice.



She must get a 6 on each dice to start the game.

Work out the probability that she will not start the game on her first throw.

Dice 2 \ Dice 1	1	2	3	4	5	6
1	1,1	1,2	1,3	1,4	1,5	1,6
2	2,1	2,2	2,3	2,4	2,5	2,6
3	3,1	3,2	3,3	3,4	3,5	3,6
4	4,1	4,2	4,3	4,4	4,5	4,6
5	5,1	5,2	5,3	5,4	5,5	5,6
6	6,1	6,2	6,3	6,4	6,5	6,6

M1 M1

P(she will not start the game on her first throw)

$= \frac{35}{36}$

$\frac{35}{36}$ A1

.....

(Total 3 mark)

5. A company sells circular mirrors.
The price P pounds of a mirror is proportional to the square of its radius r cm.

A mirror with radius 20 cm has a price of £36

Find a formula for P in terms of r.

$P \propto r^2$

$P = kr^2$ M1

When $r = 20$, $P = 36$

$36 = k \times 20^2$ M1

$36 = k \times 400$

$36 = 400k$ $\div 400$

$0.09 = k$

$P = 0.09r^2$

A1

$P =$ $0.09r^2$

(Total 3 marks)

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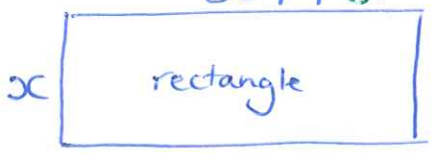
6. The width of a rectangle is a whole number of centimetres.
The length of the rectangle is 9 cm longer than its width.

let width be x
let length be $x+9$

The perimeter of the rectangle is less than 200 cm.

Find the greatest possible width of the rectangle.



Perimeter < 200

M1 $2x + 2(x+9) < 200$

$2x + 2x + 18 < 200$

$4x + 18 < 200$ -18

$4x < 182$ $\div 4$

$x < 45.5$ A1

greatest possible width $= 45$ B1 cm

(Total 4 marks)

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7. The diagram shows Diana's suitcase.
The suitcase is in the shape of a cuboid.

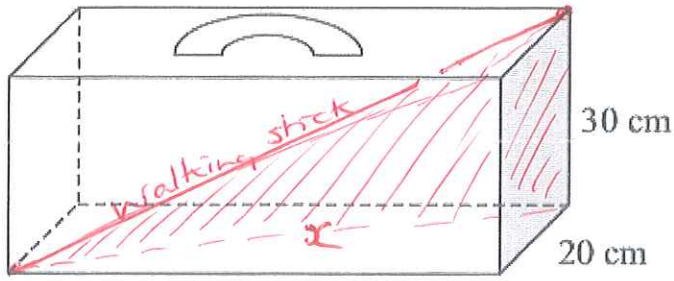


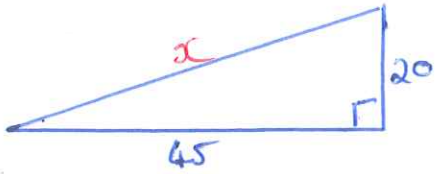
Diagram NOT accurately drawn

can the walking stick fit?

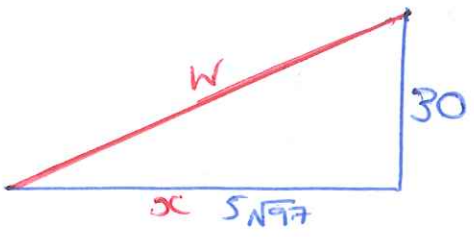
Diana has a walking stick that folds.
The folded walking stick has a length of 60 cm.

Diana wants to put the folded walking stick in the suitcase.

Will the folded walking stick fit in the suitcase?



$x^2 = 20^2 + 45^2$
$= 2425$ M1
$x = \sqrt{2425}$ M1
$= 5\sqrt{97}$ or 49.244



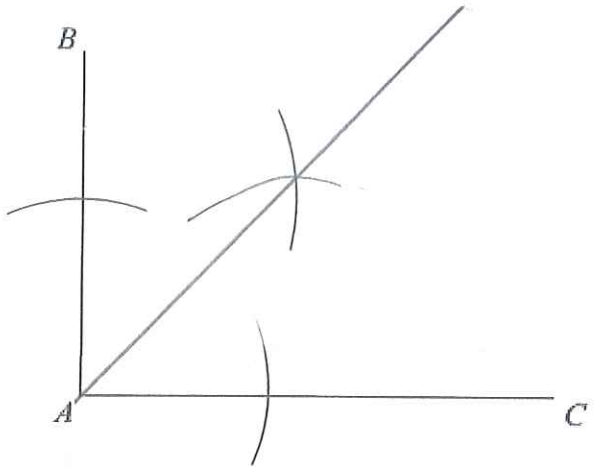
W = walking stick

$W^2 = 30^2 + (5\sqrt{97})^2$
$= 3325$
$W = \sqrt{3325}$ M1
$= 5\sqrt{133}$
$= 57.66$

C1 The folded walking stick is 60 cm long but the longest stick that can fit in the box is 57.66.
Diana cannot fit her walking stick in the suitcase as it is 2.34 cm too long.

(Total 4 marks)

8. Draw the locus of all points which are equidistant from the lines AB **and** AC.



B2

(Total 2 marks)

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9. In a sale normal prices are reduced by 20%.

A washing machine has a sale price of £464

By how much money is the normal price of the washing machine reduced?

100% − 20% = 80% M1

In the sale only 80% of the original price is paid

80% : £464 Sale Price

÷8 ↓ ↓ ÷8

10% : £58 M1

×10 ↓ ↓ ×10

100% : £580 Original Price

Reduction = Original Price − Sale Price

= £580 − £464

= £116

£ 116 A1

(Total 3 marks)

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10. The surface area of Earth is 510 072 000 km^2.
The surface area of Jupiter is 6.21795×1010 km^2. typo in Q
10^{10}

The surface area of Jupiter is greater than the surface area of Earth.
How many times greater?
Give your answer in standard form.

Jupiter $\frac{6.21795 \times 1010}{510\,072\,000} = 1.23 \times 10^{-5}$
earth

M1

Jupiter $\frac{6.21795 \times 10^{10}}{510\,072\,000} = 121.9033783$ A1

$= 1.219 \times 10^{2}$ A1

~~1.23×10^{-5}~~ (3sf)

(Total 3 marks)

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11. 25 students in class A did a science exam.
30 students in class B did the same science exam.

The mean mark for the 25 students in class A is 67.8.
The mean mark for all the 55 students is 72.0.

Work out the mean mark for the students in class B.

Class A $\quad \text{mean} = \frac{\text{total mark}}{\text{number students}}$

$67.8 = \frac{\text{total mark}}{25}$ [x25

$1695 = \text{total mark class A}$ M1

Class A and B $\quad \text{mean} = \frac{\text{total mark class A} + \text{total mark class B}}{\text{total number students}}$

$72.0 = \frac{1695 + \text{total mark class B}}{55}$ [x55

M1 $\quad 3960 = 1695 + \text{total mark class B}$ [-1695

$2265 = \text{total mark class B}$

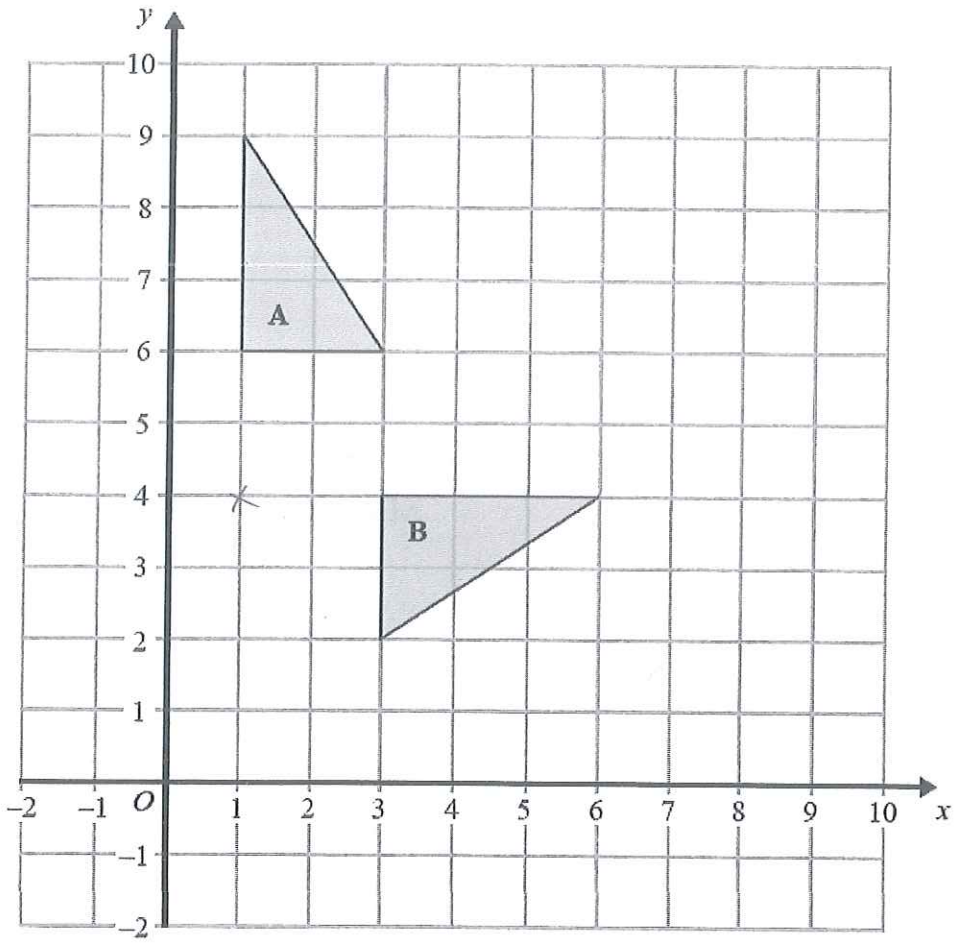
75.5

(Total 3 marks)

Class B $\quad \text{mean} = \frac{\text{total mark}}{\text{number students}}$

$= \frac{2265}{30}$ $\quad = 75.5$ A1

12.



Describe fully the single transformation that maps triangle **A** onto triangle **B**.

Rotation B1

Clockwise 90° B1

Centre (1, 4) B1

(Total 3 marks)

13. Fred has a solid brass model of an Egyptian pyramid.

The model has a volume of 3000 cm^3.
The density of the brass is 8.5 g/cm^3.

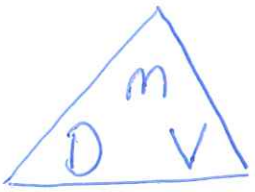
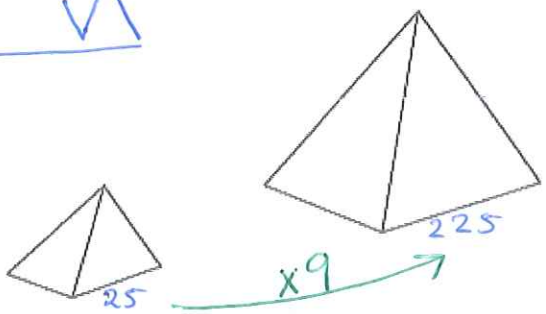


Diagram **NOT** accurately drawn



Model Egyptian pyramid

(*a*) Calculate the mass of the model.
Give your answer in kg.

$V = 3000\ cm^3$
$D = 8.5\ g/cm^3$

$m = D \times V$
$= 8.5 \times 3000$ M1
$= 25500\ g$
$\div 1000$
$= 25.5\ kg$

25.5 A1

..... kg

(2)

The model and the Egyptian pyramid are mathematically similar. The length of the base of the model is 25 cm.
The length of the base of the Egyptian pyramid is 225 m.

(*b*) Calculate the volume of the Egyptian pyramid.
Give your answer in m^3.

Scale Factor length $= \frac{225}{25} = 9$

Scale Factor area $= 9^2 = 81$

Scale Factor volume $= 9^3 = 729$ M1

$1\ m^3 = 1\,000\,000\ cm^3$

$m^3 \xrightarrow{\times 1\,000\,000} cm^3$
$cm^3 \xrightarrow{\div 1\,000\,000} m^3$

V model $= 3000\ cm^3$
V pyramid $= 3000 \times 729$
$= 2187000\ cm^3$ M1
$\div 1\,000\,000$
$= 2.187\ m^3$

2.187 A1

..... m^3

(3)

MS gives answer in cm^3 expressed in standard form

(Total 5 marks)

14. Here is a rectangular sheet of metal.
A square hole is cut out of the metal.

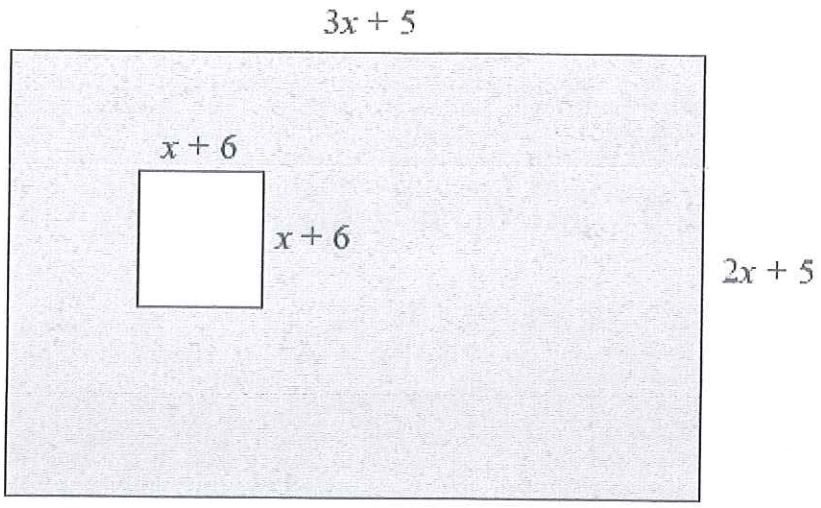


Diagram NOT accurately drawn

The length of the rectangle is $3x + 5$
The width of the rectangle is $2x + 5$
The square has sides of length $x + 6$
All measurements are in centimetres.

Perimeter square hole $= 4(x+6)$
M1 (any correct perimeter expression) $= 4x + 24$
Perimeter rectangle $= 2(3x+5) + 2(2x+5)$
$= 6x + 10 + 4x + 10$
$= 10x + 20$

The perimeter of the square hole is $\frac{3}{5}$ of the perimeter of the rectangle.

Work out the length of a side of the square hole.

$\frac{3}{5}(10x + 20) = 4x + 24$ M1 [x5

$3(10x + 20) = 5(4x + 24)$
$30x + 60 = 20x + 120$ M1 [-20x
$10x + 60 = 120$ [-60
$10x = 60$ [÷10
$x = 6$ M1

side of square hole $= x + 6$
$= 6 + 6$
$= 12$

A1

12 ..... cm

(Total 5 marks)

15. (*a*) Expand and simplify $(2x + 1)(x - 3)(x + 5)$

$= (2x+1)[x^2 + 5x - 3x - 15]$ M1

$= (2x+1)(x^2 + 2x - 15)$ M1

$= 2x^3 + 4x^2 - 30x + x^2 + 2x - 15$

$= 2x^3 + 5x^2 - 28x - 15$

error in MS
$5x^2$ not $3x^2$

A1

$2x^3 + 5x^2 - 28x - 15$

(3)

(*b*) Make *r* the subject of $5r + 1 = a(m + r)$

$5r + 1 = am + ar$ [$-ar$

$5r - ar + 1 = am$ [-1

$5r - ar = am - 1$ M1 [factorise

M1 $r(5 - a) = am - 1$ [$\div (5-a)$

$r = \frac{am - 1}{5 - a}$

A1

$r = \frac{am - 1}{5 - a}$

(3)

(Total 6 marks)

16.

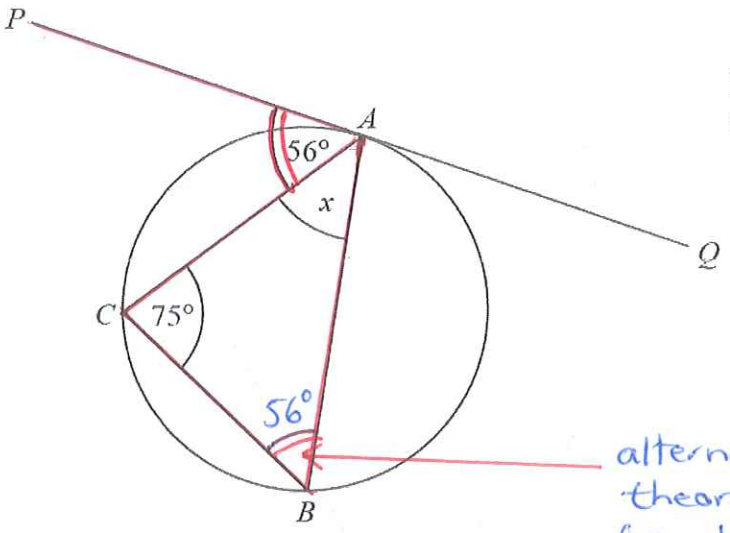


Diagram **NOT** accurately drawn

alternate segment theorem (angles in alternate segments are equal)

C1

A, B and C are points on the circumference of a circle.
The straight line PAQ is a tangent to the circle.
Angle $PAC = 56°$
Angle $ACB = 75°$

Work out the size of the angle marked x.
Give reasons for each stage of your working.

$75° + 56° = 131°$ M1

$180° - 131° = 49°$

$x = 49°$ A1

angles in a triangle add up to 180°

(Total 3 marks)

17.

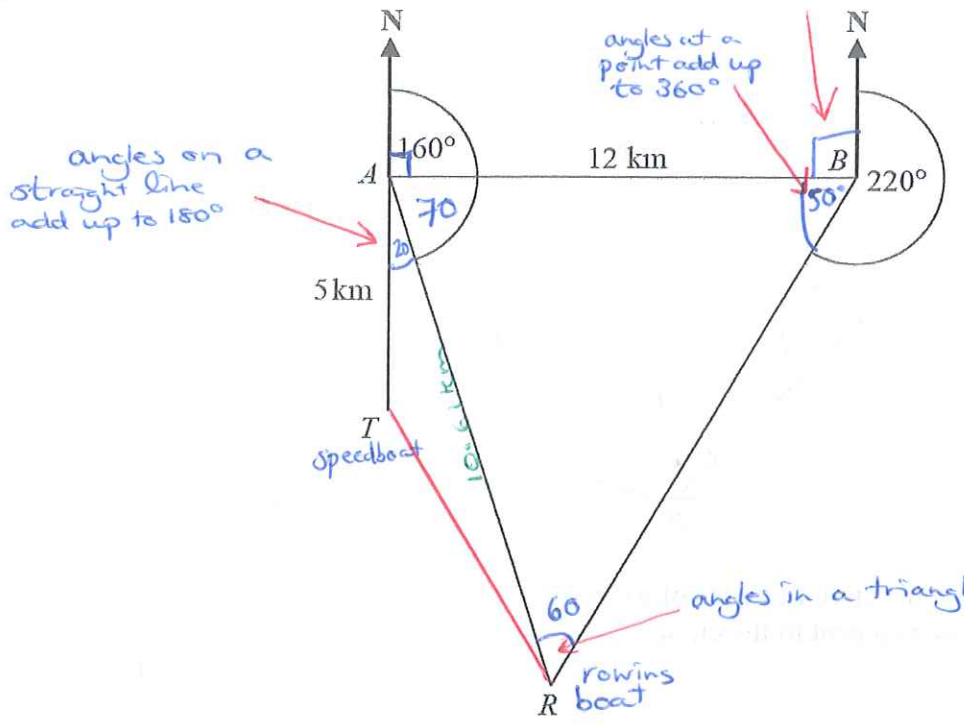


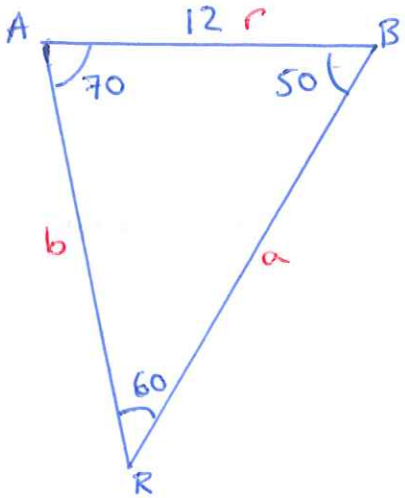
Diagram **NOT** accurately drawn

There is a coastguard station at point A and at point B.
B is due East of A.
The distance from A to B is 12 km.

There is a rowing boat at point R.
R is on a bearing of 160° from A.
R is on a bearing of 220° from B.

There is a speedboat at point T.
T is 5 km due South of A.

Work out the shortest distance from T to R.
Give your answer correct to 1 decimal place.
You must show all your working.



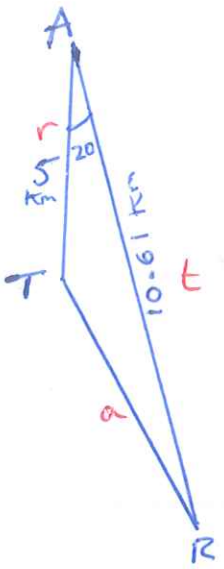
Sine Rule to find side AR

$$\frac{b}{\sin B} = \frac{r}{\sin R}$$

$$\frac{b}{\sin 50} = \frac{12}{\sin 60}$$ M1

$$b = \frac{12}{\sin 60} \times \sin 50$$

$$= 10.61462\ldots \text{ km}$$ M1



Cosine rule to find length TR

$a^2 = r^2 + t^2 - 2rt\cos A$

$(TR)^2 = 5^2 + (10.61462)^2 - 2 \times 5 \times 10.61462 \times \cos 20$

$= 37.9253944$ M1

$TR = \sqrt{37.9253944}$

$= 6.158359716$

$= 6.2$ km (1dp)

A1

.....6.2.....km

(Total 5 marks)

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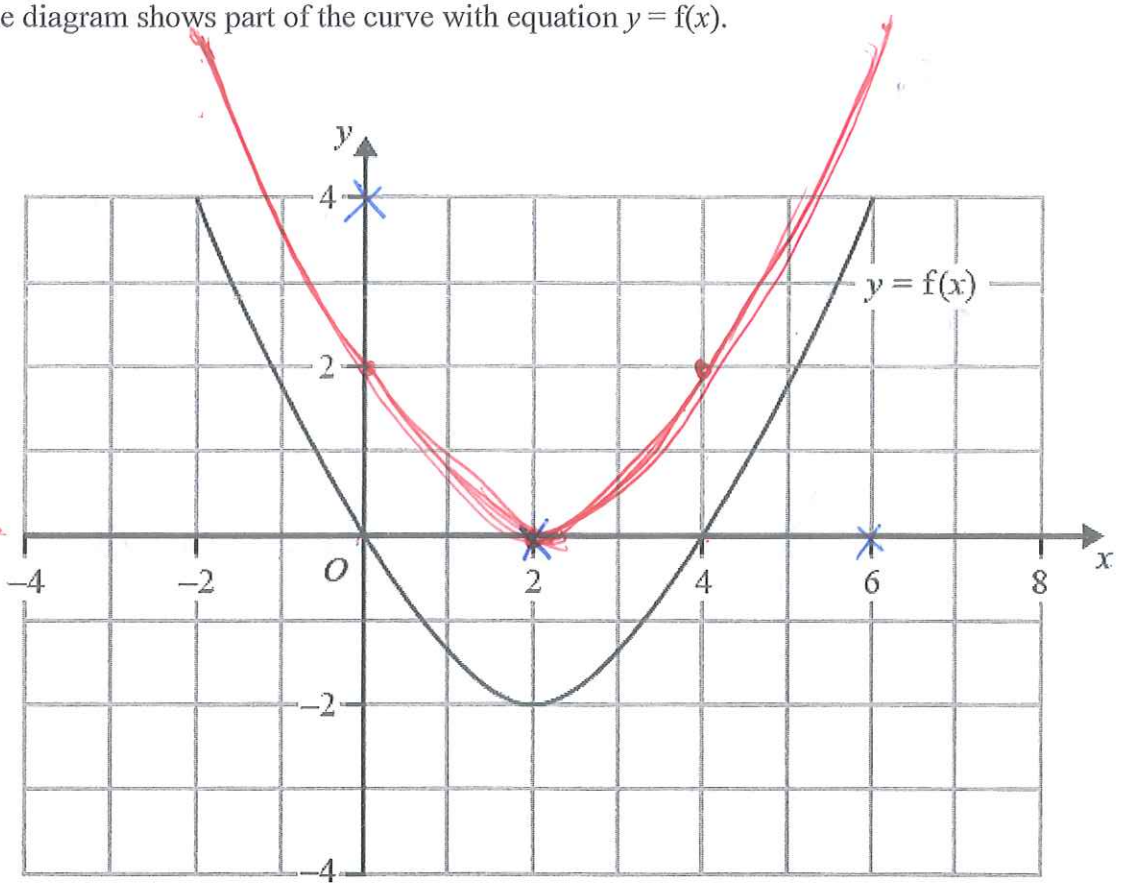
18. The diagram shows part of the curve with equation $y = f(x)$.



terrible stretch – take better care and use pencil!

(*a*) (i) Write down the coordinates of the points where the graph of $y = f(x - 2)$ crosses the x-axis.

RIGHT 2

(2 , 0) and (6 , 0) B1

(ii) Write down the coordinates of the point where the graph of $y = f(x - 2)$ crosses the y-axis.

(0 , 4) B1

(2)

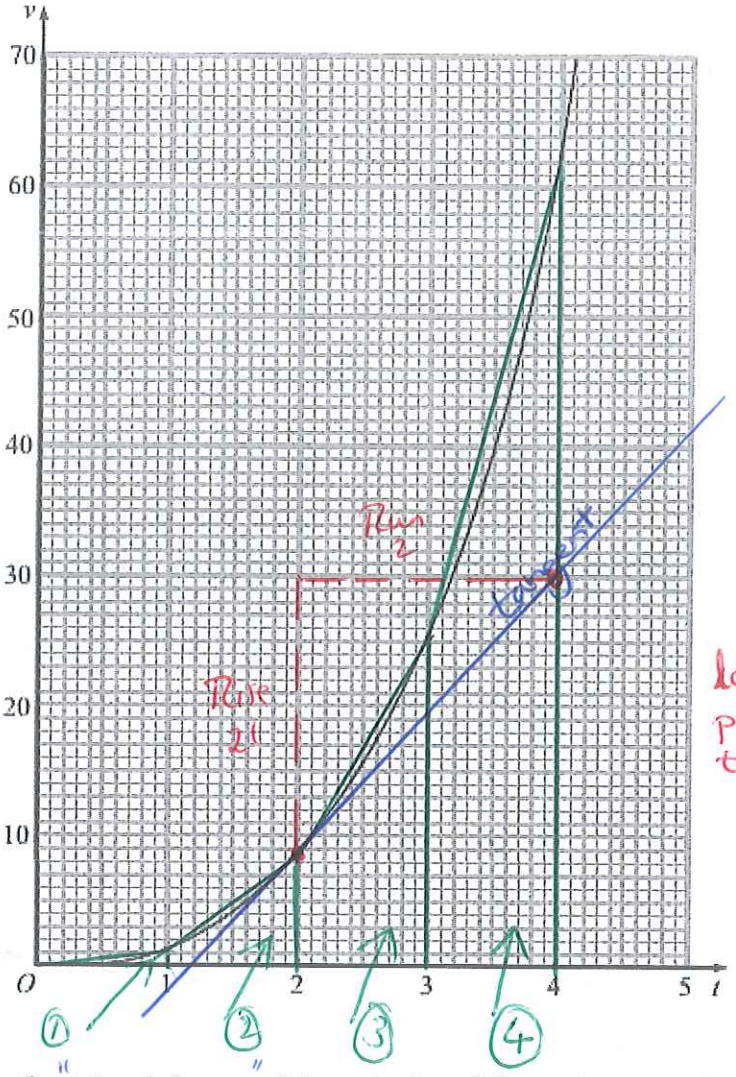
(*b*) On the diagram above, sketch the graph of $y = f(x) + 2$

UP 2 M1

A1 curve through (2,0), (0,2), (4,2) **(2)**

(Total 4 marks)

19. The graph shows the velocity, v metres per second, of a rocket at time t seconds.



(*a*) Find an estimate for the rate of change of the velocity of the rocket at $t = 2$

find the gradient of the tangent to the curve at $t = 2$ M1 (tangent drawn)

(2, 9) → (4, 30) A1 (9 → 14)

method 1 M1

$\frac{\text{rise}}{\text{run}} = \frac{21}{2} = 10.5$

method 2

$\frac{y_2 - y_1}{x_2 - x_1} = \frac{30 - 9}{4 - 2} = \frac{21}{2} = 10.5$

10.5 ..... m/s²

(3)

(*b*) Find an estimate for the distance travelled by the rocket in the first 4 seconds.

Use 4 strips of equal width

① Distance travelled = Area under curve

Area Δ ① $= \frac{1}{2} \times 1 \times 1 = 0.5$

Area trap ② $= \frac{1}{2}(1 + 9) \times 1 = 5$ M1

Area trap ③ $= \frac{1}{2}(9 + 25) \times 1 = 17$ M1

Area trap ④ $= \frac{1}{2}(25 + 62) \times 1 = 43.5$ +

66

A1 ±1

66 ..... m

(3)

(Total 6 marks)

20. Rhys has a beehive.

The number of bees in the beehive is decreasing.

Rhys counts the number of bees in the hive at the start of week 5 He counts the number of bees in the hive at the start of week 7

Here are his results.

week W	number of bees B
5	1200
7	900

Assuming that the population of bees is decreasing exponentially, how many bees were there at the start of week 2?
You must show your working.

$B = k \times x^{w}$ M1

where k and x are constants

$B = 1200$, $w = 5$ $\quad 1200 = k \times x^{5}$ (1)

$B = 900$, $w = 7$ $\quad 900 = k \times x^{7}$ (2)

(1) ÷ (2) $\quad \frac{4}{3} = \frac{k \times x^{5}}{k \times x^{7}}$ M1

$\frac{4}{3} = \frac{1}{x^{2}}$

$\frac{3}{4} = x^{2}$

$\frac{\sqrt{3}}{2} = x$ M1

Subs in (2) $\quad 900 = k \times \left(\frac{\sqrt{3}}{2}\right)^{7}$

or

$2463.36 = k$

$\therefore B = 2463.36 \times \left(\frac{\sqrt{3}}{2}\right)^{w}$ M1

Week 2, $w = 2$

$B = 2463.36 \times \left(\frac{\sqrt{3}}{2}\right)^{2}$ M1

$= 1847.52$

$= 1847$ (4sf) A1 ..... bees

(1847 → 1848)

(Total 5 marks)

21. A trapezium $ABCD$ has an area of $5\sqrt{6}$ cm^2.

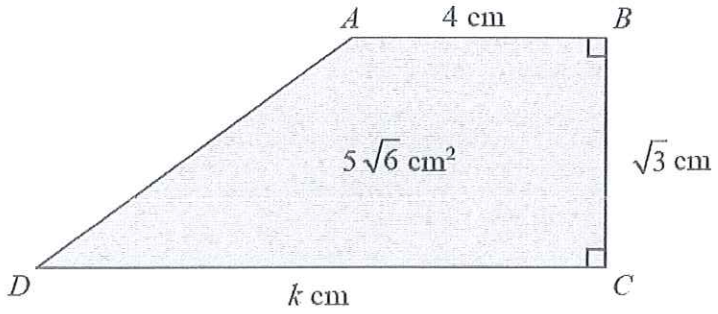


Diagram **NOT** accurately drawn

$AB = 4$ cm.
$BC = \sqrt{3}$ cm.
$DC = k$ cm.

Calculate the value of k, giving your answer in the form $a\sqrt{b} - c$, where a, b and c are positive integers.
Show each step in your working.

Area trapezium $= \frac{1}{2}(k+4) \times \sqrt{3}$ M1

$5\sqrt{6} = \frac{\sqrt{3}}{2}(k+4)$ [x 2

$10\sqrt{6} = \sqrt{3}(k+4)$ [expand brackets

$10\sqrt{6} = \sqrt{3}k + 4\sqrt{3}$ [$-4\sqrt{3}$

$10\sqrt{6} - 4\sqrt{3} = \sqrt{3}k$ [$\div \sqrt{3}$

$\frac{10\sqrt{6}}{\sqrt{3}} - \frac{4\sqrt{3}}{\sqrt{3}} = \frac{\sqrt{3}k}{\sqrt{3}}$

$\frac{10\sqrt{6}}{\sqrt{3}} - 4 = k$ M1

$\sqrt{6} = \sqrt{2\times3} = \sqrt{2}\sqrt{3}$

$\frac{10\sqrt{2}\sqrt{3}}{\sqrt{3}} - 4 = k$

$k = 10\sqrt{2} - 4$ A1

(Total 3 marks)

TOTAL FOR PAPER IS 80 MARKS