

GCSE Mathematics Practice Tests: Set 2

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.

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.

Pressure Formula

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

Tricky

1. A box is on a table.

The area of the box in contact with the table is 1500 cm^2 .
The pressure on the table is 28 newtons/m^2 .

Work out the force exerted by the box on the table.
Give your answer correct to the nearest whole number.

$p = \frac{F}{A}$ <p>p = pressure F = force A = area</p>

Convert cm^2 to m^2
($\div 100^2$)

Formula

Substitute

($\times 0.15$)

Nearest whole

$$1500 \text{ cm}^2 \div (100)^2 = 0.15 \text{ m}^2$$

$$P = \frac{F}{A}$$

$$28 \text{ N/m}^2 = \frac{F}{0.15 \text{ m}^2} \quad \dots\dots\dots 4 \text{ newtons}$$

(Total 3 marks)

$$4.2 \text{ N} = F$$

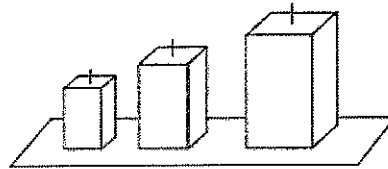
$$\underline{\underline{4 \text{ N}}} = F$$

LCM in Context

Tricky

2. Bilal is making sets of three candles.

He puts a white candle, a silver candle and a gold candle into each set.



The candles are sold in packets of different sizes.

There are

- 25 white candles in a packet
- 12 silver candles in a packet
- and 8 gold candles in a packet.

Bilal wants to use all the candles he buys.

(i) What is the smallest number of packets of white candles, of silver candles and of gold candles he needs to buy?

LCM of 8, 12, 25

③ 8: DOES 8 go into 300? ~~NO~~ : $300 \div 8 = \text{decimal}$ (600 does)

② 12: 12 24 36 48 60... keep going for multiples of 25 ONLY: = 300

① 25: 25 50 100 125 150 175 200 225 250 275 300

\therefore 600 is the LCM

White packs

$$600 \div 25 = \underline{24}$$

Silver packs

$$600 \div 12 = \underline{50}$$

Gold packs

$$600 \div 8 = \underline{75} \dots\dots\dots 24 \text{ packets of white candles}$$

$$\dots\dots\dots 50 \text{ packets of silver candles}$$

$$\dots\dots\dots 75 \text{ packets of gold candles}$$

(ii) How many sets of candles can Bilal make from the packets of candles he buys?

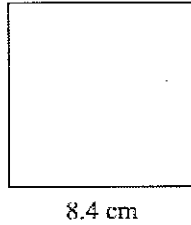
$$600 \text{ since } \text{LCM} = \underline{600}$$

$$\dots\dots\dots 600 \text{ sets}$$

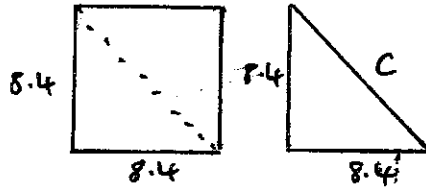
(Total 4 marks)

Pythagoras

3. A square has sides of length 8.4 cm.



Work out the length of a diagonal of the square.
Give your answer correct to 3 significant figures.



Pythagoras:

$$a^2 + b^2 = c^2$$

$$(8.4)^2 + (8.4)^2 = c^2$$

$$141.12 = c^2$$

$$11.87939... = c$$

$$11.9 \text{ cm} = c \text{ (3 s.f.)}$$

$\sqrt{\text{ANS}}$

..... 11.9 cm

(Total 3 marks)

Ratio and Proportion

4. There are a total of 120 counters in a box.

There are only red counters and blue counters in the box.

There are three times as many red counters as blue counters in the box.

Carl takes $\frac{1}{3}$ of the red counters from the box.

Kerry takes 80% of the blue counters from the box.

Work out the ratio of the number of red counters to the number of blue counters now in the box.

Give your ratio in its simplest form.

	R : B	Total
	3 : 1	120
(x30) Actual Amount	90 : 30	
($-\frac{1}{3}$ of amount)	60 : 30	90
Remove 80% Blue	60 : 6	66
Simplify ($\div 6$)	<u>10 : 1</u>	

..... 10:1

(Total 5 marks)

Area of Circles

5. The diagram shows a circular pond with a path around it.

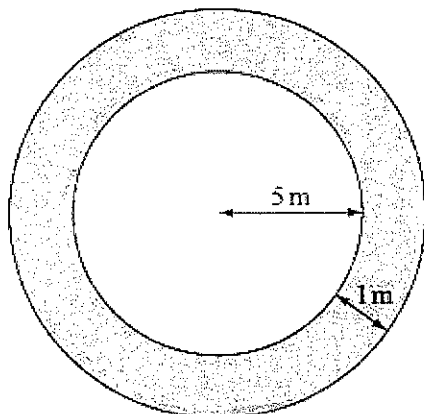


Diagram NOT accurately drawn

The pond has a radius of 5m.
The path has a width of 1m.

Work out the area of the path.
Give your answer correct to 3 significant figures.

Full Area

$$A = \pi \times r^2$$

$$A = \pi \times (6)^2$$

$$A = 36\pi$$

Small circle area

$$A = \pi \times r^2$$

$$A = \pi \times (5)^2$$

$$A = 25\pi$$

Shaded = Total - Non Shaded

$$36\pi - 25\pi = 11\pi$$

$$= 34.5575\dots$$

$$= \underline{\underline{34.6}} \text{ (3sf)} \dots \text{m}^2$$

(Total 3 marks)

Simultaneous Equations

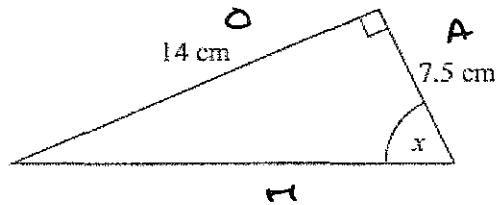
6. The total cost of 3 apples and 4 pears is £1.84

The total cost of 5 apples and 2 pears is £1.76

Work out the cost of one apple and the cost of one pear.

$\begin{aligned} & \textcircled{2} \times 2: \\ & \textcircled{3} - \textcircled{1} \\ & \\ & (\div 7) \\ & \\ & \text{In } \textcircled{1}: \\ & \\ & (-0.72) \\ & (\div 4) \end{aligned}$	$\begin{aligned} 3a + 4p &= \pounds 1.84 \quad \textcircled{1} \\ 5a + 2p &= \pounds 1.76 \quad \textcircled{2} \\ 10a + 4p &= \pounds 3.52 \quad \textcircled{3} \\ 10a + 4p &= \pounds 3.52 \\ 3a + 4p &= \pounds 1.84 \quad \textcircled{-} \\ \hline 7a &= \pounds 1.68 \\ a &= \pounds \underline{\underline{0.24}} \\ \\ 3a + 4p &= \pounds 1.84 \\ 3(0.24) + 4p &= \pounds 1.84 \\ 4p &= \pounds 1.12 \\ \text{Cost of one apple} &= \pounds \underline{\underline{0.28}} \quad 24 \text{ p} \\ \text{Cost of one pear} & \dots\dots\dots 28 \text{ p} \end{aligned}$
<p>(Total 4 marks)</p>	

7. Here is a right-angled triangle.



Work out the size of the angle marked x .
Give your answer to the nearest degree.

SOLICANTO A

$$\tan \theta = \frac{O}{A}$$

$$\tan \theta = \frac{14}{7.5}$$

$$\theta = \tan^{-1}\left(\frac{14}{7.5}\right)$$

$$= 61.82140\dots$$

$$= \underline{\underline{62^\circ}} \text{ (nearest degree)}$$

shift tan

62.

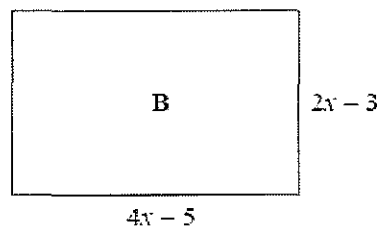
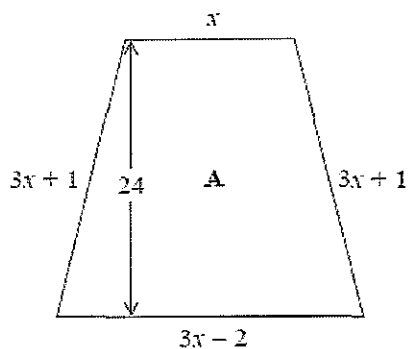
(Total 3 marks)

Forming and Solving Equations

8. Jake is making badges of different shapes.

Badge A is in the shape of a trapezium.

Badge B is in the shape of a rectangle.



All measurements are in centimetres.

The perimeter of badge A and the perimeter of badge B are equal.

Jake needs to work out the area of badge A.

The area of badge A is t cm².

Work out the value of t .

Perimeter A

$$= 3x + 1 + x + 3x + 1 + 3x - 2 = 10x$$

Perimeter B

$$= 4x - 5 + 4x - 5 + 2x - 3 + 2x - 3 = 12x - 16$$

Equal Perimeters

$$10x = 12x - 16$$

(+16)

$$16 + 10x = 12x$$

(-10x)

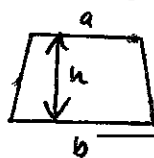
$$16 = 2x$$

(÷2)

$$8 = x$$

Area of Trapezium:

$$A = \frac{h(a+b)}{2}$$



$$h = 24$$

$$a = x = 8$$

$$b = 3x - 2 = 22$$

$$A = \frac{24(8+22)}{2}$$

$$A = \underline{\underline{360}}$$

360

(Total 6 marks)

Angles in Parallel Lines

9.

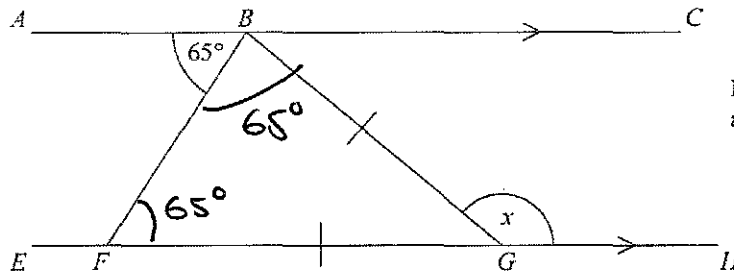


Diagram NOT
accurately drawn

ABC is parallel to $EFGH$.

$GB = GF$

Angle $ABF = 65^\circ$

Work out the size of the angle marked x .

Give reasons for your answer.

$$\hat{BFG} = \hat{ABF} = 65^\circ$$

$$\hat{BFG} = \hat{FBG} = 65^\circ$$

$$\begin{aligned} \hat{BGF} &= 180^\circ - 65^\circ - 65^\circ \\ &= 50^\circ \end{aligned}$$

$$x^\circ = 180^\circ - 50^\circ = \underline{\underline{130^\circ}}$$

Alternate angles are the same.

Base angles of isosceles triangle are the same.

Angles in a triangle = 180°

Angles on a straight line = 180°

(Total 4 marks)

Cosine Rule

10. A circular clock face, centre O , has a minute hand OA and an hour hand OB .
 $OA = 10$ cm.
 $OB = 7$ cm.

Calculate the length of AB when the hands show 5 o'clock.

Give your answer correct to 3 significant figures.

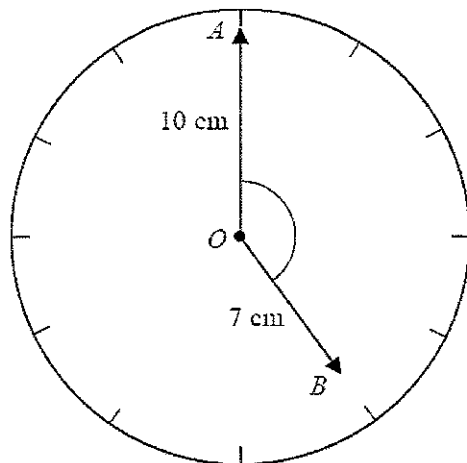
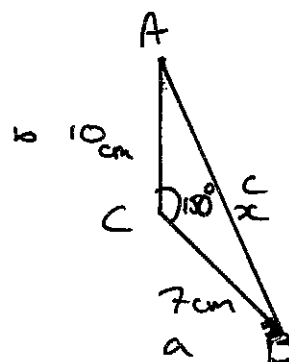
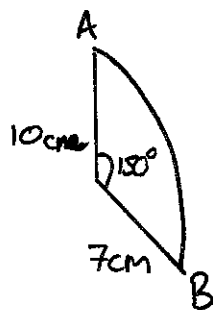


Diagram NOT accurately drawn

$$5 \text{ o'clock} = \frac{5}{12} \text{ of a circle}$$

$$\frac{5}{12} \times 360^\circ = 150^\circ$$



Cosine Rule

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$\sqrt{\text{ANS}}$

$$\therefore x^2 = (10)^2 + (7)^2 - 2(10)(7) \cos(150)$$

$$x^2 = 270.24 \dots$$

$$x = 16.4 \text{ cm (3 s.f.)}$$

$$\dots\dots\dots 16.4 \dots \text{ cm}$$

(Total 4 marks)

11. There are 200 workers at a factory.

The cumulative frequency table gives information about their ages.

Age (a years)	Cumulative frequency
$0 < a \leq 20$	25
$0 < a \leq 30$	70
$0 < a \leq 40$	138
$0 < a \leq 50$	175
$0 < a \leq 60$	186
$0 < a \leq 70$	194
$0 < a \leq 80$	200

(a) On the grid opposite, draw a cumulative frequency graph for this information.

(2)

(b) Graham says,

“10% of workers at the factory are older than 65”

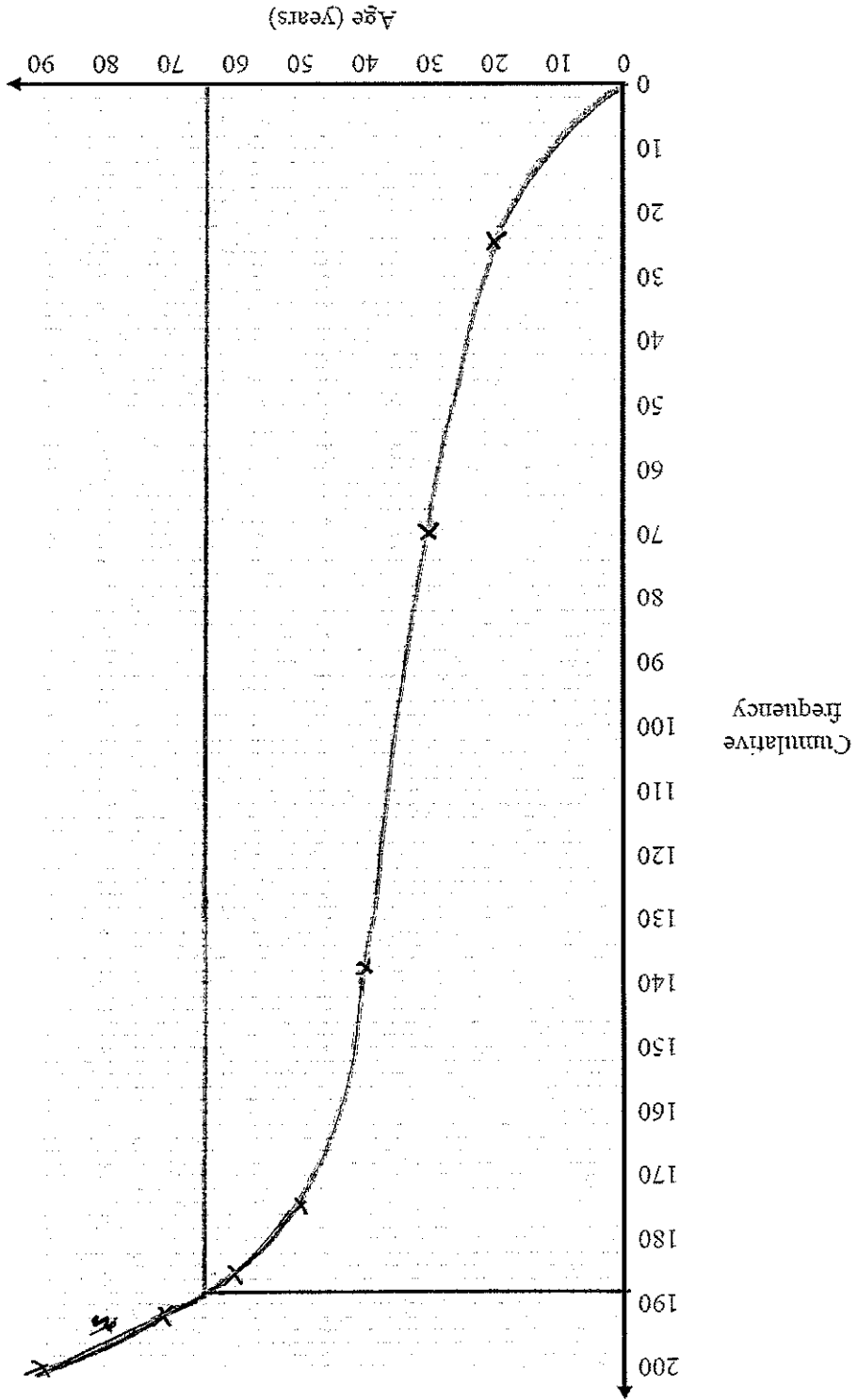
Is Graham correct?

You must show how you get your answer.

188 workers are 65 or younger, so 12 are older than 65. $\frac{12}{200}$ is NOT = 10%
 \therefore Graham is wrong

(2)

(Total 4 marks)



Reverse Percentages

12. When a number is reduced by 30% the answer is 17920
What is the number?

	$100\% - 30\% = 70\%$
	$17920 = 70\%$
$(\div 70)$	$256 = 1\%$
$(\times 100)$	$25600 = 100\%$

25600

(Total 3 marks)

Independent Event Probability Trees

13. There are only

4 mint biscuits
and 1 toffee biscuit in a tin.

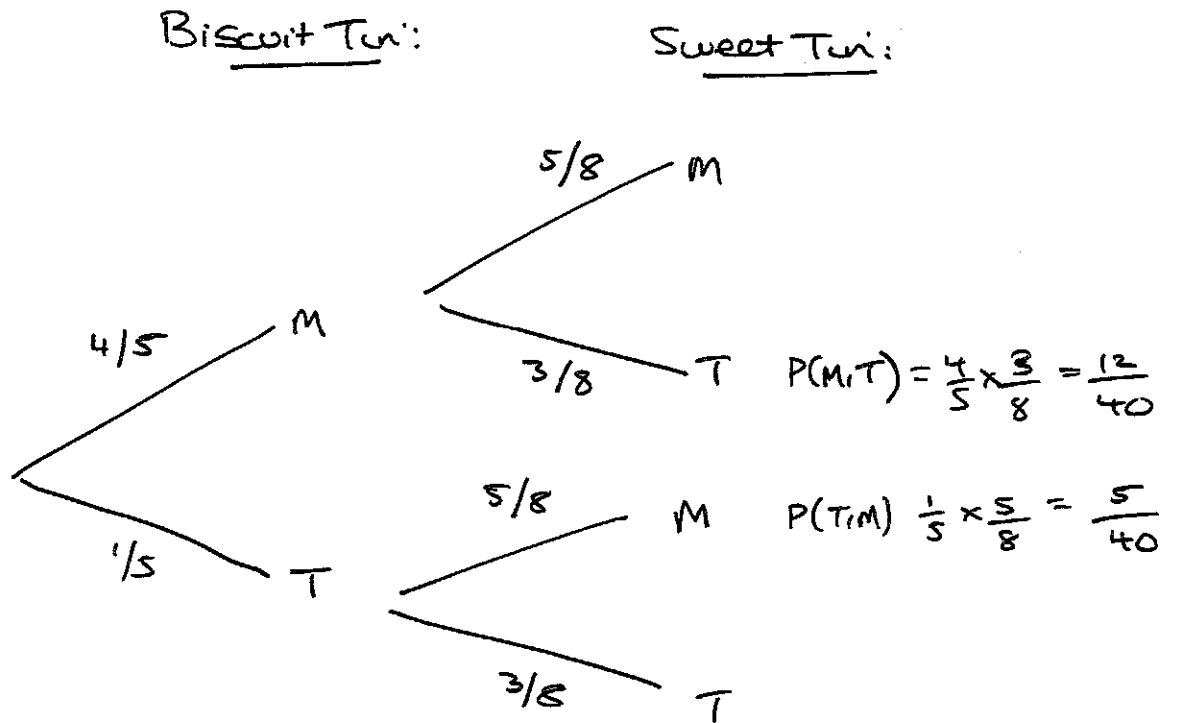
There are only

5 mint sweets
and 3 strawberry sweets in a packet.

Michael's mum lets him take one biscuit from the tin and one sweet from the packet.

Michael takes a biscuit at random from the tin.
He also takes a sweet at random from the packet.

Work out the probability that either the biscuit is mint or the sweet is mint, but not both.



Biscuit OR sweet but not both: $P(M,T) + P(T,M)$

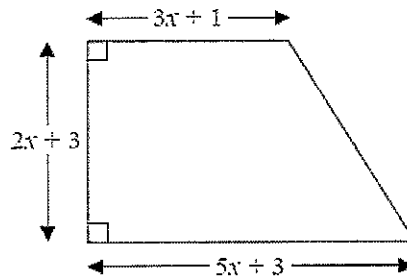
$$P(M,T) = \frac{12}{40}$$

$$P(T,M) = \frac{5}{40}$$

$$\therefore \frac{12}{40} + \frac{5}{40} = \frac{17}{40}$$

(Total 3 marks)

14. The diagram shows a trapezium.



All the measurements are in centimetres.
The area of the trapezium is 46 cm^2 .

(a) Show that $x^2 + 2x - 5 = 0$

$$a = 3x + 1$$

$$b = 5x + 3$$

$$h = 2x + 3$$

collect

expand

collect

$$A = \frac{h(a+b)}{2}$$

$$A = \frac{(2x+3)(3x+1+5x+3)}{2}$$

$$A = \frac{(2x+3)(8x+4)}{2}$$

$$A = \frac{16x^2 + 8x + 24x + 12}{2}$$

$$A = \frac{16x^2 + 32x + 12}{2}$$

simplify

$$A = 46$$

$$(-46)$$

$$(\div 8)$$

$$A = 8x^2 + 16x + 6$$

$$46 = 8x^2 + 16x + 6$$

$$0 = 8x^2 + 16x - 40$$

$$0 = \underline{\underline{x^2 + 2x - 5}}$$

□

(3)

(b) Solve the equation $x^2 + 2x - 5 = 0$
Give your solutions correct to 2 decimal places.

\therefore Quadratic Formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$a = 1$$

$$b = 2$$

$$c = -5$$

$$x = \frac{-(2) \pm \sqrt{(2)^2 - 4(1)(-5)}}{2(1)}$$

$$\underline{\underline{x_+ = 1.45}} \quad (2 \text{ d.p.})$$

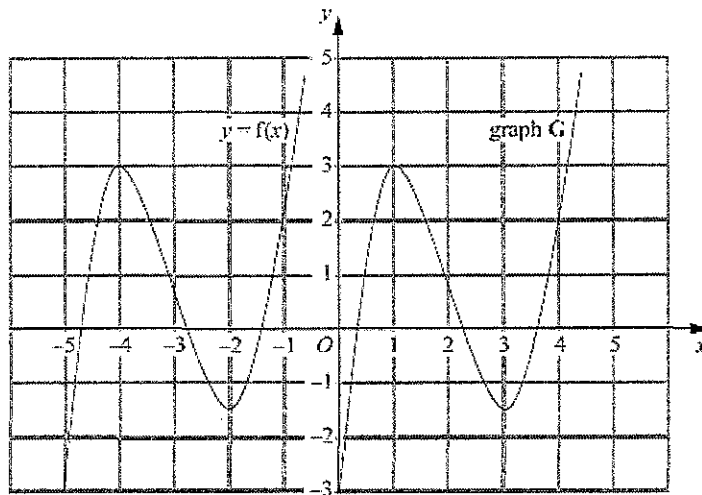
$$\underline{\underline{x_- = -3.45}} \quad (2 \text{ d.p.})$$

(3)

(Total 6 marks)

Transformations of Graphs

15. The graph of $y = f(x)$ is shown on the grid.



The graph **G** is a translation of the graph of $y = f(x)$.

- (a) Write down, in terms of f , the equation of graph **G**.

Has been moved right by 5 places... $f(x-5)$

$$y = f(x-5) \dots\dots\dots (1)$$

The graph of $y = f(x)$ has a maximum point at $(-4, 3)$.

- (b) Write down the coordinates of the maximum point of the graph of $y = f(-x)$.

Input has been negated.

$$(\dots\dots\dots 4, \dots\dots\dots 3) \dots\dots\dots (2)$$

(Total 3 marks)

Recurring Decimals

16. ^{Typo} $x = 0.0\overline{15}$ $x = 0.0\overline{15}$

Prove algebraically that x can be written as $\frac{1}{66}$

let $x = 0.0151515\dots$

$10x = 0.151515\dots$

$100x = 1.51515\dots$

$1000x = 15.15151\dots$

$$\begin{array}{r} 1000x - 10x = 15.151515\dots \\ \quad \quad \quad \underline{0.151515\dots} \end{array} \quad \ominus$$

$(\div 990)$	$990x = 15$ $x = \frac{15}{990} = \frac{1}{66} \quad \square$	(Total 3 marks)
--------------	--	-----------------

17. P is inversely proportional to the square of x .

Inverse Proportion

Given that $x = 5$ when $P = 6$, find the value of P when $x = 8$

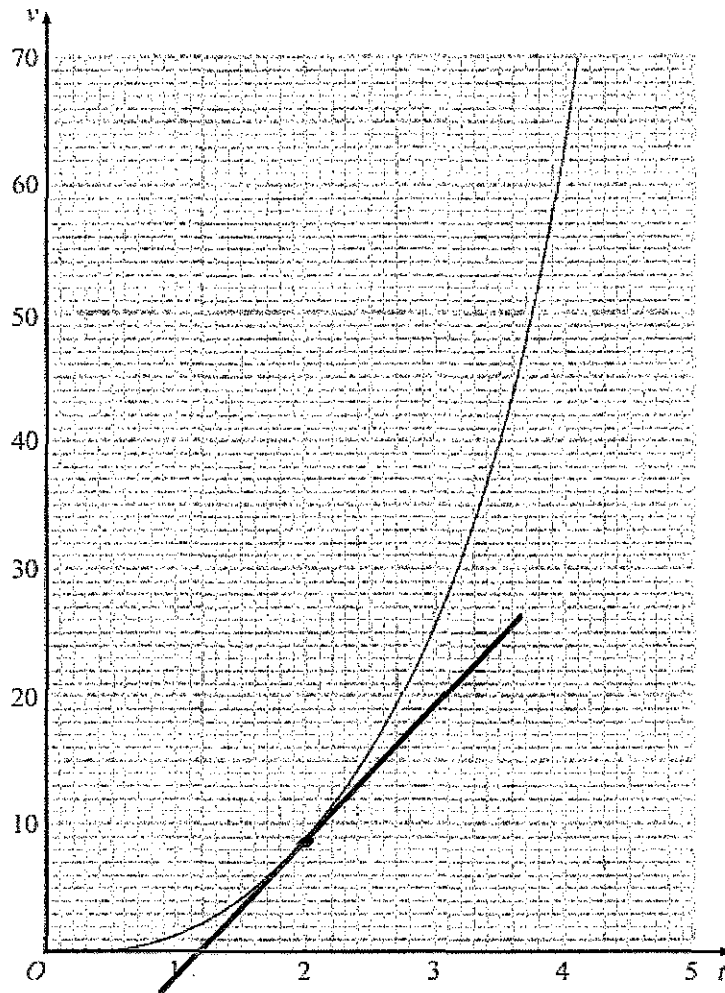
Give your answer correct to 2 decimal places.

<p>Inverse Proportion</p> <p>$x = 5, P = 6$</p> <p>(x25)</p>	$P \propto \frac{1}{x^2}$ $P = \frac{k}{x^2}$ $6 = \frac{k}{(5)^2}$ $6 = \frac{k}{25}$ $150 = k$	$k = 150$ $x = 8$	$P = \frac{150}{x^2}$ $P = \frac{150}{(8)^2}$ $P = \frac{150}{64}$ $P = 2.34$ <p style="text-align: right;">(2dp)</p>
<p>$P = \underline{\quad 2.34 \quad}$</p>			

(Total 3 marks)

Velocity Time Graphs

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



Find an estimate for the rate of change of the velocity of the rocket at $t=2$

Gradient of Curve

Draw Tangent

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

(2, 8.5) and (3, 19)

$$m = \frac{19 - 8.5}{3 - 2} = \frac{10.5}{1} = \underline{\underline{10.5}}$$

..... 10.5 m/s²

(Total 3 marks)

Bounds

19. A road is 4530 m long, correct to the nearest 10 metres.
Kirsty drove along the road in 205 seconds, correct to the nearest 5 seconds.

The average speed limit for the road is 80 km/h.

Could Kirsty's average speed have been greater than 80 km/h?
You must show your working.

WANT: To compare greatest possible speed

D error

$$4530 \begin{array}{l} +5 \\ -5 \end{array} \begin{array}{l} 4535 \text{ } D_{\max} \\ 4525 \text{ } D_{\min} \end{array} \quad 10 \div 2 = 5$$

T error

$$205 \begin{array}{l} +2.5 \\ -2.5 \end{array} \begin{array}{l} 207.5 \text{ } T_{\max} \\ 202.5 \text{ } T_{\min} \end{array} \quad 5 \div 2 = 2.5$$

$$S_{\max} = \frac{D_{\max}}{T_{\min}}$$

$$S_{\max} = \frac{4535 \text{ m}}{202.5 \text{ s}} = 22.395 \text{ m/s}$$

convert m/s to km/h ...

$$60 \text{ secs} = 1 \text{ minute}$$

$$\therefore 3600 \text{ secs} = 1 \text{ hour}$$

$$22.395 \text{ m/s} =$$

$$= 22.395 \times 3600 \text{ m/h} = 80622 \text{ m/h}$$

$$= 80622 \div 1000 \text{ km/h} = 80.622 \text{ km/h}$$

Conclusion

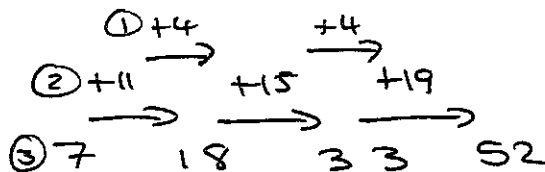
Yes, it is possible she went over 80 km/h on average
(Total 5 marks)

Quadratic Sequences

20. Here are the first 4 terms of a quadratic sequence. $\Rightarrow an^2 + bn + c$

7 18 33 52

Find an expression, in terms of n , for the n th term of the sequence.



$2a = 4$		$\Rightarrow a = 2$	
$3a + b = 11$		$\Rightarrow 3(2) + b = 11$	$\therefore 6 + b = 11 \Rightarrow b = 5$
$a + b + c = 7$		$\Rightarrow 2 + 5 + c = 7$	$\therefore 7 + c = 7 \Rightarrow c = 0$
$an^2 + bn + c$		$\therefore \underline{\underline{2n^2 + 5n}}$	(Total 3 marks)

Inverse Functions

21. $g(x) = \frac{4x}{3-x}$

$f(x) = 2x - 5$

Given that $x > 3$, find the exact value of x such that $g^{-1}(x) = f(x)$.

$g^{-1}(x):$ $(x(3-x))$ expand $(+3x)$ factorise: $(\div(4+y))$ Notation:	$y = \frac{4x}{3-x}$ $y(3-x) = 4x$ $3y - \cancel{xy} = 4x$ $3y = 4x + \cancel{xy}$ $3y = x(4+y)$ $\frac{3y}{4+y} = x$ $\frac{3x}{4+x} = g^{-1}(x)$	$g^{-1}(x) = f(x)$ $(x(4+x))$ expand collect $(-3x)$ $(\div 2)$ Difference of two squares solve: Given $x > 3$ (Total 5 marks)	$\frac{3x}{4+x} = 2x - 5$ $3x = (2x-5)(4+x)$ $3x = 8x + 2x^2 - 20x - 5x$ $3x = 2x^2 + 3x - 20$ $0 = 2x^2 + 0x - 20$ $0 = x^2 + 0x - 10$ $0 = x^2 - 10$ $0 = (x + \sqrt{10})(x - \sqrt{10})$ $x = \pm \sqrt{10}$ $\therefore x = \underline{\underline{\sqrt{10}}}$
---	--	---	---

TOTAL FOR PAPER IS 80 MARKS