Write your name here

Surname	Other names

Pearson Edexcel
Level 1/Level 2 GCSE (9 - 1)

Centre Number | | | | | |

Candidate Number | | | | |

Mathematics model answers

Paper 2 (Calculator)

Higher Tier

Specimen Papers Set 2
Time: 1 hour 30 minutes

Paper Reference
1MA1/2H

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

Total Marks

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.**
- If your calculator does not have a π button, take the value of π to be 3.142 unless the question instructs otherwise.
- 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.

Turn over ▶

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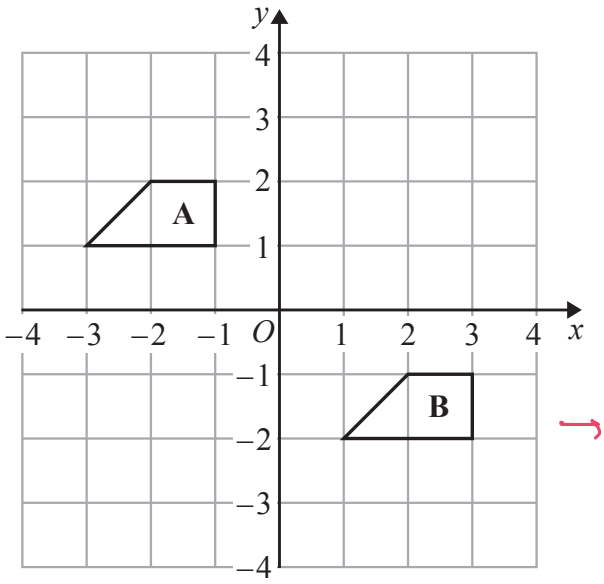
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Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1



→ shape moves 4 right, 3 down

Describe the single transformation that maps shape **A** onto shape **B**.

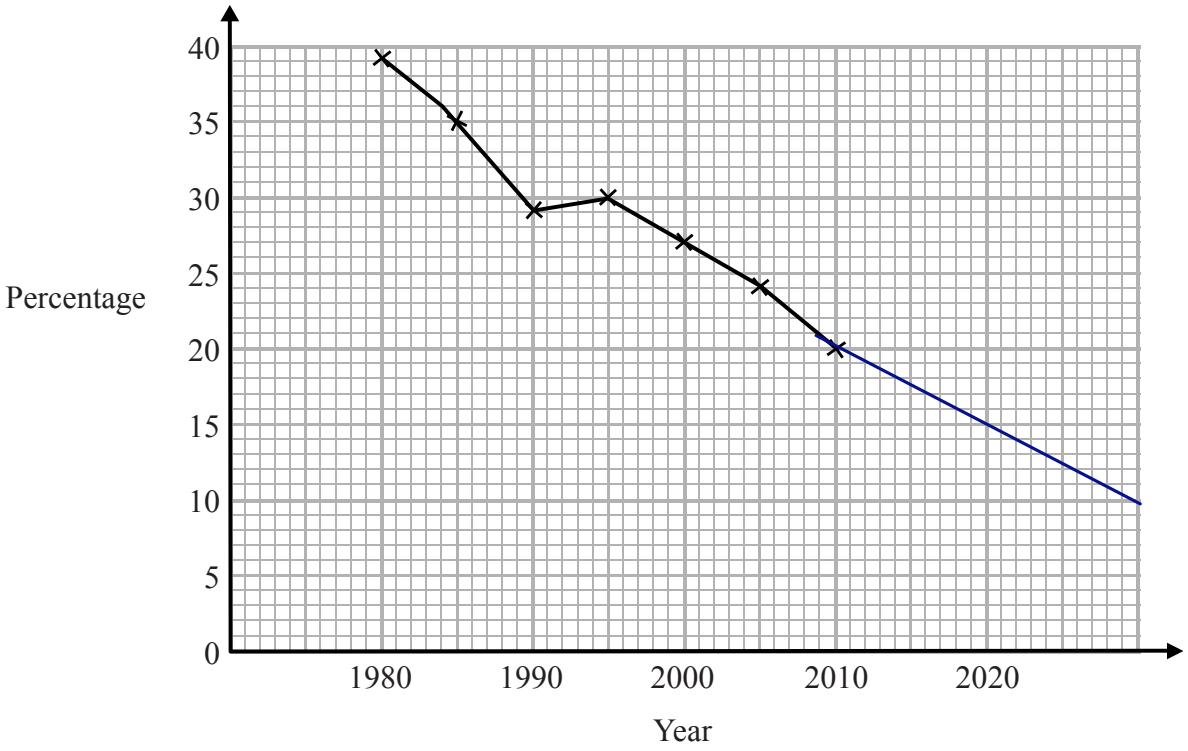
translation by $\begin{pmatrix} 4 \\ -3 \end{pmatrix}$

(Total for Question 1 is 2 marks)

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2 The time series graph shows information about the percentages of the people in a village that used the village shop for the years between 1980 and 2010



(a) Describe the trend in the percentage of the people in the village who used the shop for this period.

percentage of people who used the shop decreases over time

(1)

(b) (i) Use the graph to predict the percentage of the people in the village likely to use the shop in the year 2020

continue the line on the graph to read off %.

15 %

(allowed 13 - 17 %)

(ii) Is your prediction reliable?
Explain your answer.

No, 2020 is beyond the time period in the data range given, so we have to extrapolate, which is unreliable.

extend beyond range of data given

(3)

(Total for Question 2 is 4 marks)

3 (a) Expand and simplify $3(y - 2) + 5(2y + 1)$

$= 3y - 6 + 10y + 5$) expand brackets

$= 13y - 1$) collect like terms

$13y - 1$

(2)

(b) Simplify $5u^2w^4 \times 7uw^3$

$= 5 \times 7 \times u^2 \times u^1 \times w^4 \times w^3$

$= 35u^3w^7$ ← add powers when multiplying terms of the same base

$35u^3w^7$

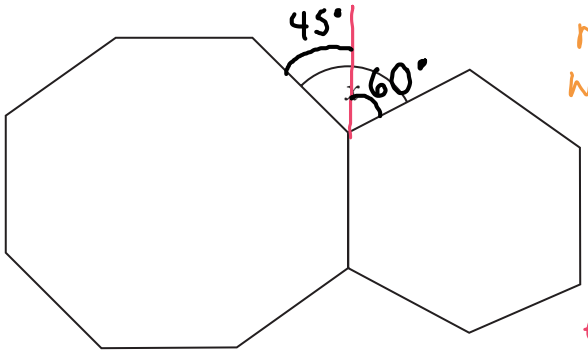
(2)

(Total for Question 3 is 4 marks)

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4



exterior angle of a regular polygon with n sides
$= \frac{360}{n}$
(as sum of all exterior angles is 360)

The diagram shows a regular octagon and a regular hexagon.

Find the size of the angle marked x
You must show all your working.

octagon: exterior angle $= \frac{360}{8} = 45°$

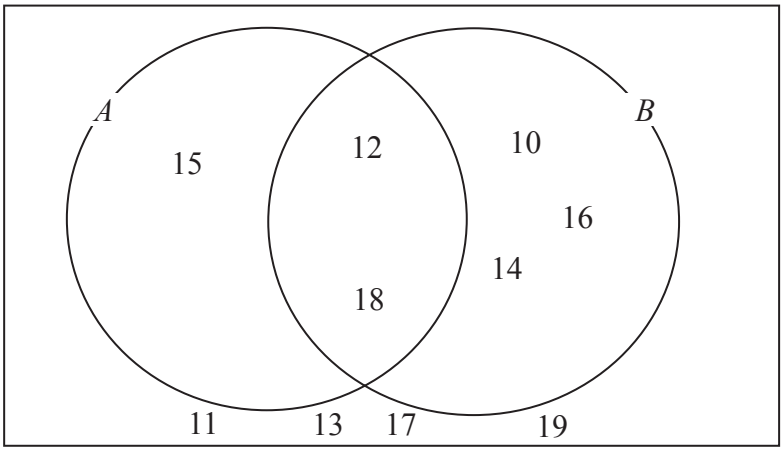
hexagon: exterior angle $= \frac{360}{6} = 60°$

$x = 45 + 60 = 105°$

$x =$ 105 °

(Total for Question 4 is 3 marks)

5 Here is a Venn diagram.



(a) Write down the numbers that are in set

(i) $A \cup B$

↓ in A or B or both

10, 12, 14, 15, 16, 18

(ii) $A \cap B$

↓ in A and B

12, 18

(2)

One of the numbers in the diagram is chosen at random.

(b) Find the probability that the number is in set A'

10 numbers in total

In set A' means not in set A

↳ 7 numbers not in A

P(in set A') = $\frac{7}{10}$

$\frac{7}{10}$

(2)

(Total for Question 5 is 4 marks)

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6 On a farm

the number of cows and the number of sheep are in the ratio 6 : 5
the number of sheep and the number of pigs are in the ratio 2 : 1

The total number of cows, sheep and pigs on the farm is 189

How many sheep are there on the farm?

C : S = 6 : 5 (x2) → 12 : 10 and S : P = 2 : 1 (x5) → 10 : 5

to get sheep to be the same number

C : S : P = 12 : 10 : 5

number of parts = 12 + 10 + 5 = 27

$\frac{10}{27}$ animals are sheep

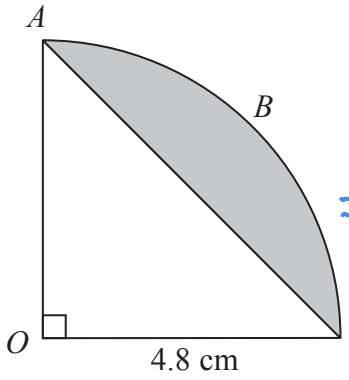
no. sheep = $189 \times \frac{10}{27} = 70$

189 animals in total

70

(Total for Question 6 is 3 marks)

7



The arc ABC is a quarter of a circle with centre O and radius 4.8 cm.
AC is a chord of the circle.

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

area of sector:

$= \frac{1}{4} \times$ area of circle

$= \frac{1}{4} \times \pi \times 4.8^2$

$= 5.76\pi \text{ cm}^2$

area of white triangle:

$= \frac{1}{2} \times$ base $\times$ height

$= \frac{1}{2} \times 4.8 \times 4.8 = 11.52 \text{ cm}^2$

shaded area = area of sector − area of triangle

$= 5.76\pi - 11.52$

$= 6.58 \text{ cm}^2$ (3sf)

6.58 cm²

(Total for Question 7 is 3 marks)

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8 Steve is asked to solve the equation $5(x + 2) = 47$

Here is his working.

$$5(x + 2) = 47$$
$$5x + 2 = 47$$
$$5x = 45$$
$$x = 9$$

Steve's answer is wrong.

(a) What mistake did he make?

the brackets have been expanded incorrectly

$5(x+2) = 5x+10$

(1)

Liz is asked to solve the equation $3x^2 + 8 = 83$

Here is her working.

$$3x^2 + 8 = 83$$
$$3x^2 = 75$$
$$x^2 = 25$$
$$x = 5$$

(b) Explain what is wrong with Liz's answer.

she has not obtained both solutions after line 3

$x^2 = 25$

$x = \pm 5$

(1)

(Total for Question 8 is 2 marks)

9 The functions f and g are such that

$$f(x) = 3(x - 4) \quad \text{and} \quad g(x) = \frac{x}{5} + 1$$

(a) Find the value of f(10)

$f(10) = 3(10-4) = 3(6) = 18$

* replace x with 10 in the formula for $f(x)$

18

(1)

(b) Find $g^{-1}(x)$

$y = g(x)$

$y = \frac{x}{5} + 1$

$y - 1 = \frac{x}{5}$ — rearrange to find x

$5(y-1) = x$, so replace y with x to get $g^{-1}(x)$

$g^{-1}(x) = 5(x-1)$

$g^{-1}(x) =$ $5(x-1)$

(2)

(c) Show that $ff(x) = 9x - 48$

$ff(x) = f(3(x-4)) = f(3x-12)$

$\Rightarrow 3(3x-12-4)$ — expand

$= 3(3x-16)$

$= 9x - 48$

(2)

(Total for Question 9 is 5 marks)

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10 The population of a city increased by 5.2% for the year 2014

At the beginning of 2015 the population of the city was 1 560 000

Lin assumes that the population will continue to increase at a constant rate of 5.2% each year.

(a) Use Lin's assumption to estimate the population of the city at the beginning of 2017
Give your answer correct to 3 significant figures.

increase by 5.2% → multiplier = 1.052

population in 2016: $1560000 \times 1.052 = 1641120$

in 2017: $1641120 \times 1.052 = 1730000$ (3sf)

or, $1560000 \times 1.052^{2} = 1730000$ (3sf)

(2 years)

1730000

(3)

(b) (i) Use Lin's assumption to work out the year in which the population of the city will reach 2 000 000

$1560000 \times 1.052^{n} > 2000000$ → n = number of years after 2015

n = 4 ⇒ population = 1 910 678 < 2 000 000

n = 5 ⇒ population = 2 010 034 > 2 000 000

2015 + 5 years = 2020

2020

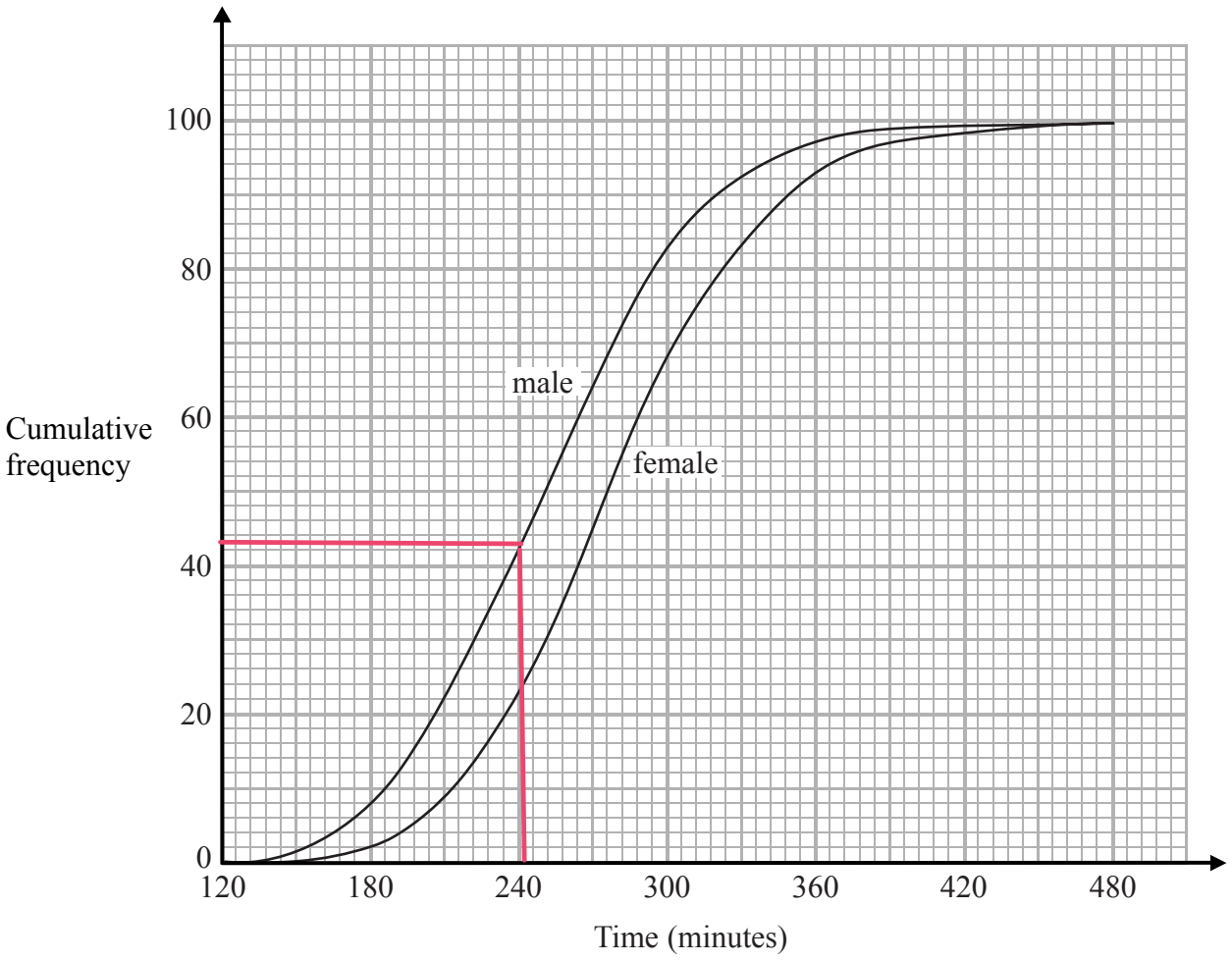
(ii) If Lin's assumption about the rate of increase of the population is too low, how might this affect your answer to (b)(i)?

If the percentage increase per year was higher, a population of 2000000 will be reached sooner.

(3)

(Total for Question 10 is 6 marks)

11 The cumulative frequency graphs show information about the times taken by 100 male runners and by 100 female runners to finish the London marathon.



A male runner is chosen at random.

(a) Find an estimate for the probability that this runner took less than 4 hours to finish the London marathon.

4hrs = 4 x 60 mins = 240 mins
(1hr = 60 mins)

at t = 240, cumulative frequency of males = 43

so, $\frac{43}{100}$ males finished in under 4hrs

↳ probability = 0·43

0·43

(2)

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(b) Use medians and interquartile ranges to compare the distribution of the times taken by the male runners with the distribution of the times taken by the female runners.

	male	female	
median	252	273	cf = 50
lower quartile	215	241	cf = 25
upper quartile	287	312	cf = 75
IQ range	72	71	lower q - upper q

read these off the graph

- the median for females is higher, so on average they take longer to finish
- the IQ range is similar for males and females, so the spread of times is roughly the same.

(4)

(Total for Question 11 is 6 marks)

12 Marie has 25 cards.
Each card has a different symbol on it.

Marie gives one card to Shelley and one card to Pauline.

(a) In how many different ways can Marie do this?

$25 \times 24 = 600$

↑ 1 card less for the second person to be given

600

(2)

There are 12 boys and 10 girls in David's class.
David is going to pick three different students from his class and write their names in a list in order.

The order will be

boy girl boy	**or**	girl boy girl

(b) How many different lists can David write?

boy
girl
boy
} $12 \times 10 \times 11 = 1320$

girl
boy
girl
} $10 \times 12 \times 9 = 1080$

total no. combinations =
$1320 + 1080 = 2400$

2400

(3)

(Total for Question 12 is 5 marks)

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13 The number of slugs in a garden t days from now is p_t where

$p_0 = 100$

$p_{t+1} = 1.06p_t$

Work out the number of slugs in the garden 3 days from now.

$P_1 = 1.06 \times 100 = 106$

$P_2 = 1.06 \times 106 = 112.36$

$P_3 = 1.06 \times 112.36 = 119.1$ must be rounded to a whole number

119

(Total for Question 13 is 3 marks)

14 D is directly proportional to the cube of n.

Mary says that when n is doubled, the value of D is multiplied by 6

Mary is wrong.
Explain why.

$D \propto n^3$, so $D = kn^3$

double $n \rightarrow$ new $D = k \times (2n)^3$

$= k \times 8n^3 = 8kn^3$

$= 8D$

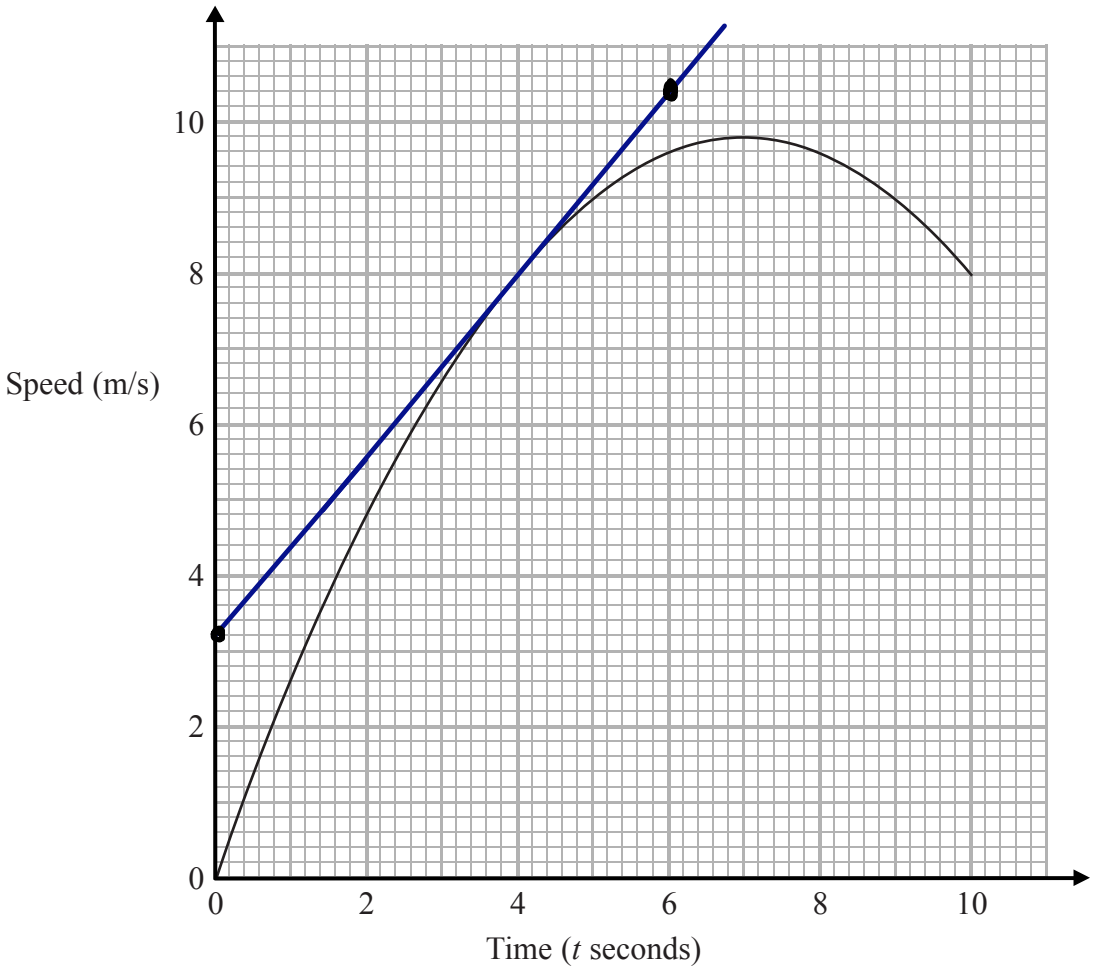
She is wrong because the value of D is multiplied by 8

(1)

(Total for Question 14 is 1 mark)

15 Karol runs in a race.

The graph shows her speed, in metres per second, t seconds after the start of the race.



(a) Calculate an estimate for the gradient of the graph when $t = 4$
You must show how you get your answer.

gradient = $\frac{\text{change in } y}{\text{change in } x}$

$= \frac{10.4 - 3.2}{6 - 0} = \frac{7.2}{6} = 1.2$

1.2

(3)

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(b) Describe fully what your answer to part (a) represents.

speed / time = acceleration

the acceleration 4 seconds after the start of the race

(2)

(c) Explain why your answer to part (a) is only an estimate.

it depends on how accurate the tangent is drawn.

would get different values depending on how the tangent is drawn.

(1)

(Total for Question 15 is 6 marks)

16 (i) Find the value of $\sqrt[5]{3.2 \times 10^{11}}$

put in calculator

200

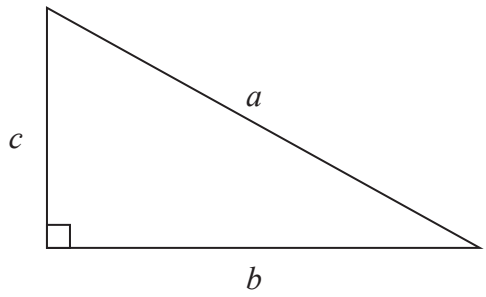
(ii) Find the value of $10^{\frac{3}{4}}$

Give your answer correct to 1 decimal place.

5·6

(Total for Question 16 is 2 marks)

17



a is 8.3 cm correct to the nearest mm
b is 6.1 cm correct to the nearest mm

Calculate the upper bound for *c*.
You must show your working.

LB UB

$8.25 \leq a \leq 8.35$

$6.05 \leq b \leq 6.15$

Pythagoras' theorem:

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

$c^2 = a^2 - b^2$

upper bound of $c = \sqrt{(\text{UB of } a)^2 - (\text{LB of } b)^2}$

$= \sqrt{8.35^2 - 6.05^2}$

$= \sqrt{33.12}$

$= 5.754...\text{cm}$ 5.754997828 cm

(Total for Question 17 is 4 marks)

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18 Simplify fully $(\sqrt{a} + \sqrt{4b})(\sqrt{a} - 2\sqrt{b})$

$\sqrt{4b} = \sqrt{4} \times \sqrt{b} = 2b$

$= (\sqrt{a} + 2\sqrt{b})(\sqrt{a} - 2\sqrt{b})$ → difference of two squares

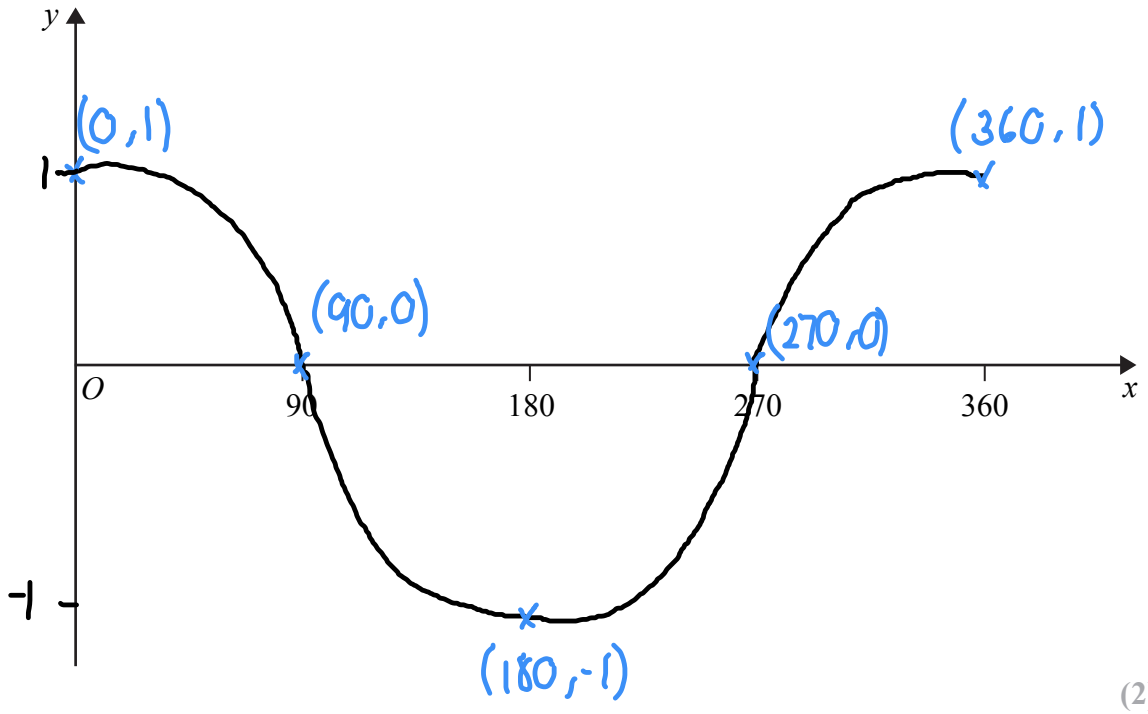
$= a - 2\sqrt{ab} + 2\sqrt{ab} - 4\sqrt{b^2}$

$= a - 4b$

$a - 4b$

(Total for Question 18 is 3 marks)

19 (a) Sketch the graph of $y = \cos x°$ for $0 \leqslant x \leqslant 360$



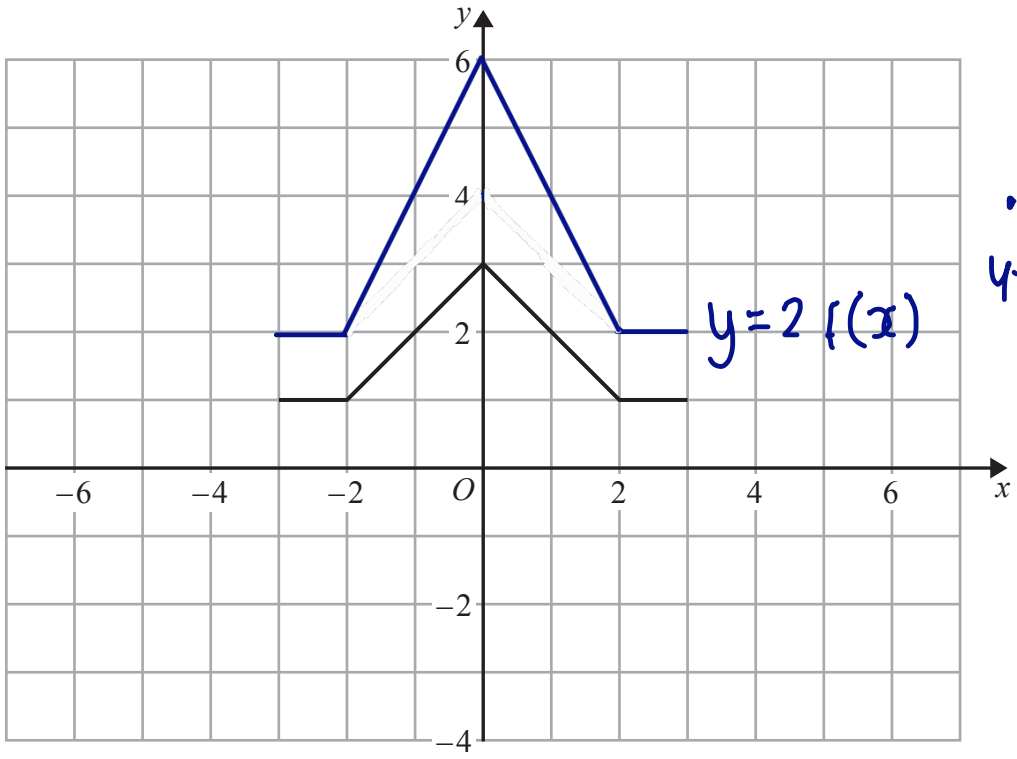
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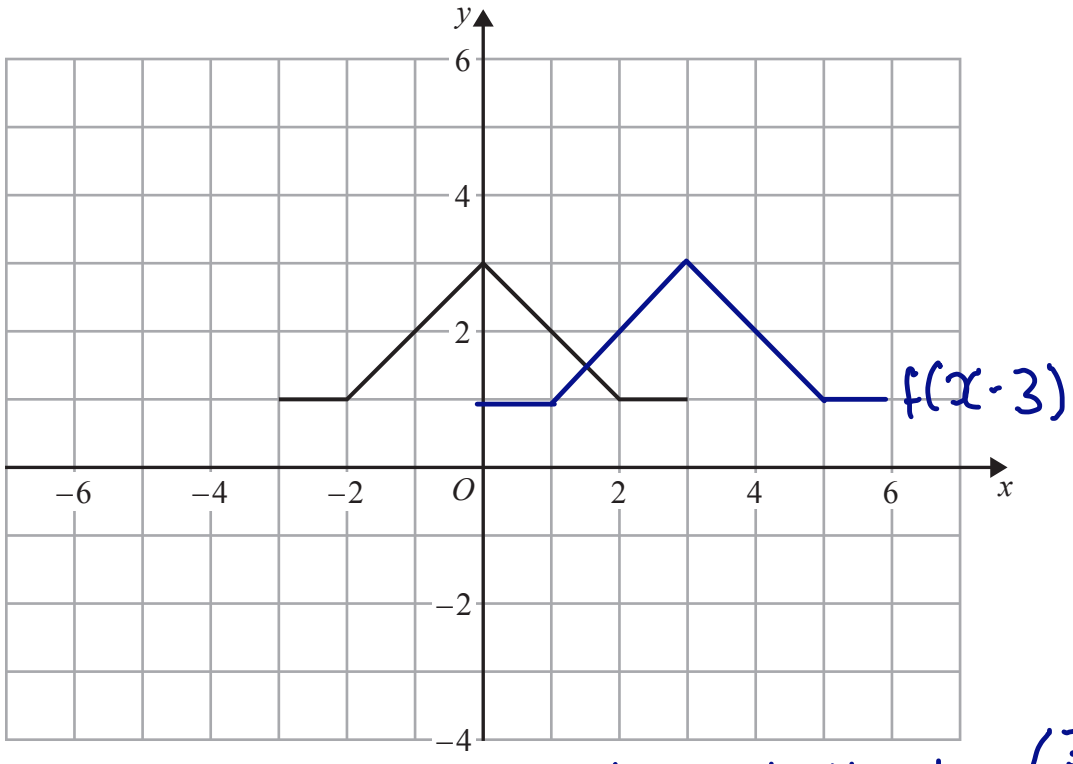
(b) The graph of $y = f(x)$ is shown on both grids below.

(i) On this grid, draw the graph of $y = 2f(x)$



• multiply y-coordinates by 2

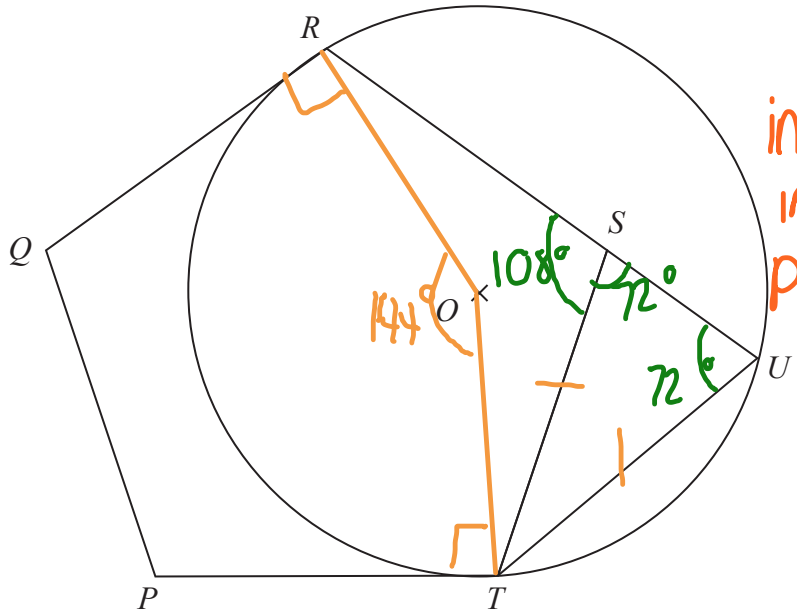
(ii) On the grid below, draw the graph of $y = f(x - 3)$



• translation by $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ (2)

(Total for Question 19 is 4 marks)

20



interior angles in a regular polygon with n sides: $\frac{180(n-2)}{n}$

PQRST is a regular pentagon.
R, *U* and *T* are points on a circle, centre *O*.
QR and *PT* are tangents to the circle.
RSU is a straight line.

Prove that $ST = UT$.

interior angle of regular pentagon $= \frac{180(5-2)}{5} = 108°$

So, $\angle TSR = 108°$

$\angle TSU = 180 - 108 = 72°$ as angles on a straight line sum 180°

$\angle QRO = \angle PTO = 90°$ (tangent to circle is perpendicular to radius)

total angles in a pentagon ↑

$\angle ROT = 540 - 90 - 90 - 108 - 108 = 144°$

$\angle RUT = 72°$ (angle at the centre is twice the angle at the circumference)

$\frac{144}{2} = 72$

ΔSUT is isosceles, because the base angles are equal, hence $ST = UT$

(Total for Question 20 is 5 marks)

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21 Given that

$$2x - 1 \ : \ x - 4 \ = \ 16x + 1 \ : \ 2x - 1$$

find the possible values of x.

$$\frac{2x-1}{16x+1} = \frac{x-4}{2x-1}$$ cross-multiply

$$(2x-1)(2x-1) = (16x+1)(x-4)$$ expand brackets

$$4x^2 - 2x - 2x + 1 = 16x^2 - 64x + x - 4$$

$$0 = 12x^2 - 59x - 5$$

$$0 = (12x+1)(x-5)$$ factorise

set each bracket to 0

$12x + 1 = 0$

$12x = -1$

$x = -\frac{1}{12}$

$x - 5 = 0$

$x = 5$

$x = -\frac{1}{12}$, $x = 5$

(Total for Question 21 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS