

**Tuesday 03 November 2020 – Morning**

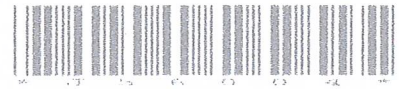
**GCSE (9–1) Mathematics**

**J560/04 Paper 4 (Higher Tier)**

**Time allowed: 1 hour 30 minutes**

**You can use:**

- a scientific or graphical calculator
- geometrical instruments
- tracing paper



Please write clearly in black ink. **Do not write in the barcodes.**

Centre number

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Candidate number

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First name(s) \_\_\_\_\_

Last name \_\_\_\_\_

### INSTRUCTIONS

- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. You can use extra paper if you need to, but you must clearly show your candidate number, the centre number and the question numbers.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working. Marks might be given for using a correct method, even if your answer is wrong.
- Use the  $\pi$  button on your calculator or take  $\pi$  to be 3.142 unless the question says something different.

### INFORMATION

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [ ].
- This document has **20** pages.

### ADVICE

- Read each question carefully before you start your answer.

Answer all the questions.

1 (a) Write these numbers in standard form.

(i) 6500

(a)(i)  $6.5 \times 10^3$  ..... [1]

(ii) 0.0584

(ii)  $5.84 \times 10^{-2}$  ..... [1]

(b) Work out  $(4.2 \times 10^5) \times (1.8 \times 10^{-2})$ , giving your answer in standard form.

(b)  $7.56 \times 10^3$  ..... [1]

2 James is taking three examination papers in Spanish.  
Here are his first two results.

Paper 1:  $\frac{43}{80}$

Paper 2:  $\frac{38}{65}$

Paper 3 is out of 95.

The marks in each of the three papers are added together.

Find the lowest mark that James needs in Paper 3 to achieve 60% of the total marks.

total marks  $80 + 65 + 95 = 240$

$$\frac{43 + 38 + x}{240} = 0.6$$

$$81 + x = 144$$

$$x = 63$$

.....  $63$  ..... [4]

- 3 Three people take  $2\frac{1}{2}$  hours to deliver leaflets to 270 houses.

Assuming all people deliver leaflets at the same rate, how long will it take five people to deliver leaflets to 405 houses?

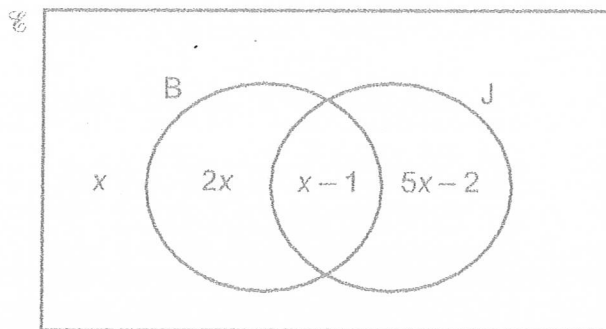
Give your answer in hours and minutes.

$$\begin{array}{l}
 3 \text{ people} = 2.5 \text{ hours} = 270 \text{ houses} \\
 1 \text{ person} = 7.5 \text{ hours} = 270 \text{ houses} \\
 5 \text{ people} = 1.5 \text{ hours} = 270 \text{ houses} \\
 5 \text{ people} = 2.25 \text{ hours} = 405 \text{ houses} \\
 0.25 \text{ hours} = 15 \text{ minutes}
 \end{array}
 \begin{array}{l}
 \left. \begin{array}{l} \\ \\ \end{array} \right\} \times 3 \\
 \left. \begin{array}{l} \\ \\ \end{array} \right\} \div 5 \\
 \left. \begin{array}{l} \\ \\ \end{array} \right\} \times \frac{405}{270}
 \end{array}$$

.....2..... hours .....15..... minutes [4]

- 4 In a survey, 60 students were asked whether they have a bank account (B) and whether they have a part-time job (J).

The number of students who had neither a bank account nor a part-time job was  $x$ .  
The Venn diagram shows the results in terms of  $x$ .



One of the 60 students is chosen at random.

Find the probability that they have a bank account.  
Show your working.

$$x + 2x + x - 1 + 5x - 2 = 9x - 3$$

$$9x - 3 = 60$$

$$9x = 63$$

$$x = 7$$

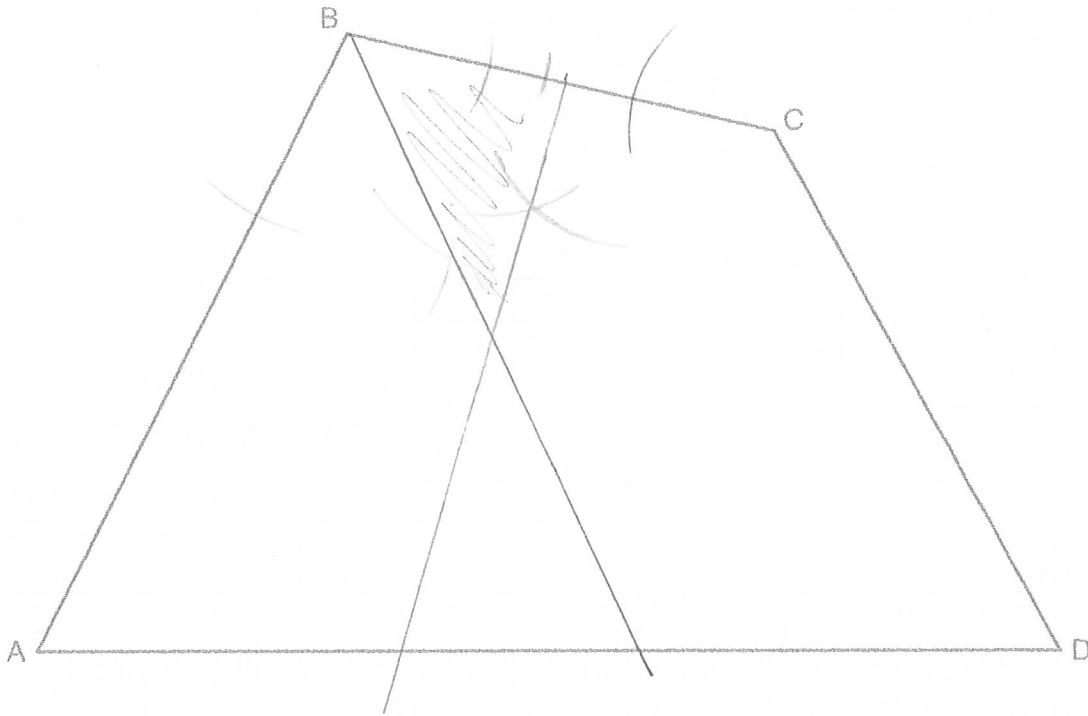
$$\text{bank account} : 3x - 1 = 20$$

$$\frac{20}{60} = \frac{1}{3}$$

$$\frac{1}{3}$$

[5]

5 ABCD is a quadrilateral.



(a) Construct the bisector of angle ABC.  
Show all your construction lines.

[2]

(b) Construct the perpendicular bisector of BC.  
Show all your construction lines.

[2]

(c) Shade the region which is

- nearer to BC than to AB
- and
- nearer to B than to C.

[1]

- 6 A cuboid measures 6 cm by 8 cm by 15 cm.  
A cube has the same volume as the cuboid.

Find the surface area of the cube, giving your answer correct to 3 significant figures.

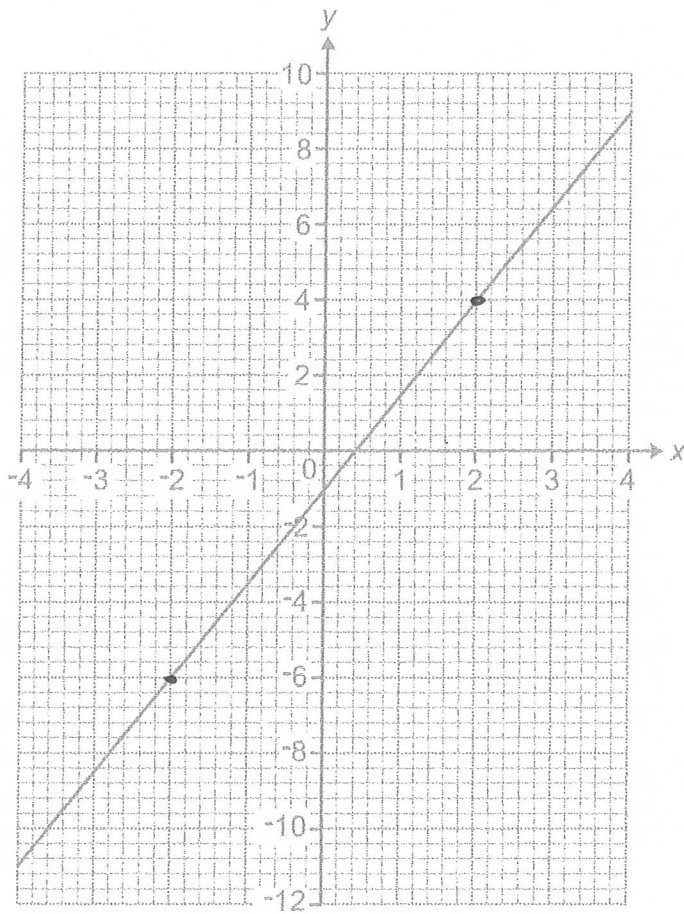
$$\text{Volume of cuboid: } 6 \times 8 \times 15 = 720 \text{ cm}^3$$

$$\text{Side length of cube: } \sqrt[3]{720} = 8.96 \text{ cm}$$

$$\text{Surface area} = 6 \times 8.96^2 = 482 \text{ cm}^2$$

..... 482 ..... cm<sup>2</sup> [4]

- 7 This graph shows part of a straight line.



- (a) Show that the gradient of the line is 2.5.

[1]

$$(2, 4) - (-2, -6)$$

$$\text{gradient} = \frac{10}{4} = 2.5$$

- (b) Write down the equation of the line.

$$y = 2.5x - 1$$

(b) ..... [2]

8 Lily buys and sells microwaves.

She buys each one for £32 and sells it for £60.

She also pays £7 for the delivery of each microwave she sells.

If she sells a microwave that is faulty then Lily must pay for its repair and redelivery.

This costs her another £25 for each faulty microwave.

Last month, 6 out of the 80 microwaves Lily sold were faulty.

This month she has orders for 133 microwaves.

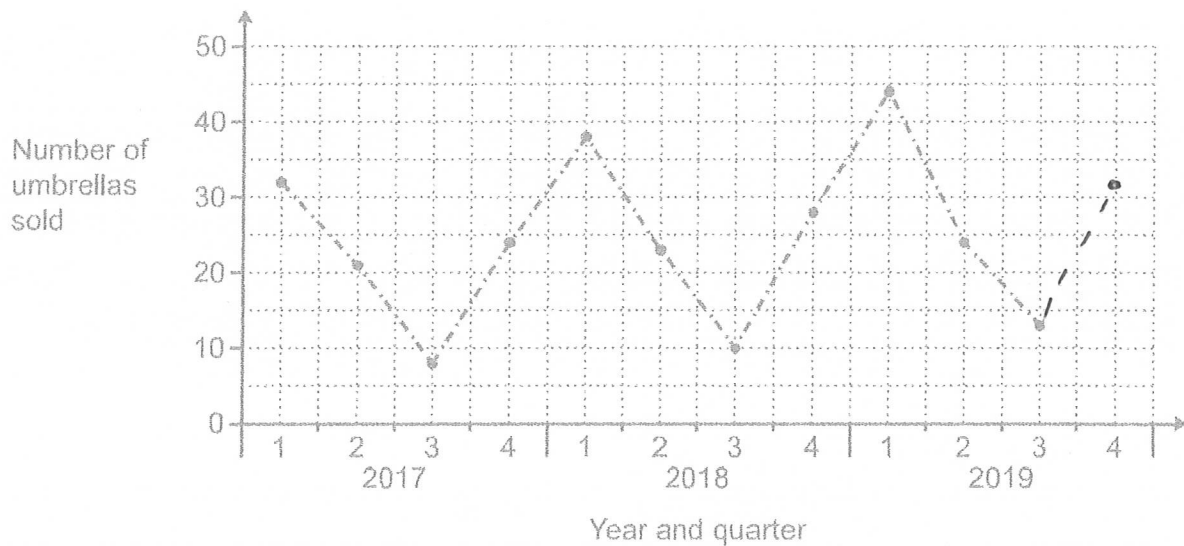
Calculate her expected percentage profit on this month's order.

Showing your working in the boxes below may help you present your work.

<p>Expected number of faulty microwaves:</p> $\frac{6}{80} \times 133 = 10$	<p>Expected costs:</p> <p>cost of microwaves:  <math>133 \times 32 = 4256</math></p> <p>cost of deliveries:  <math>133 \times 7 = 931</math></p> <p>cost of faulty microwaves:  <math>25 \times 10 = 250</math></p> <p>total costs = 5437</p>
<p>Income from sales:</p> $133 \times 60 = 7980$	<p>Expected percentage profit:</p> $\frac{7980 - 5437}{5437} \times 100$ $= 46.77$

..... 46.77 ..... % [6]

- 9 The graph shows the number of umbrellas sold in Ling's shop for each quarter from quarter 1 of 2017 to quarter 3 of 2019.



- (a) The shop sold 32 umbrellas in quarter 4 of 2019.

Complete the graph.

[1]

- (b) Make one comment about the **seasonal** variation shown in this graph.

peaks in Q1 and dips in Q3

[1]

- (c) Make one comment about the **annual** variation shown in this graph.

small rise in sales year on year

[1]

- (d) Ling predicts that she will sell 50 umbrellas in quarter 1 of 2020.

What assumption has she made?

the trend in sales will continue at a similar rate

[1]



- 10 The diagram shows Jane's lawn.  
It is in the shape of a square of side 36 m and three semi-circles.



She is going to spread fertiliser on the lawn at a rate of 30 g per square metre.  
The fertiliser is only sold in 10 kg bags costing £15.80 each.

Calculate the cost of buying the bags of fertiliser for her lawn.  
You must show all your working.

$$A \quad 36 \times 36 = 1296 \text{ m}^2$$

$$B \quad 3 \times \frac{\pi \times 18^2}{2} = 486\pi$$

$$\text{fertiliser needed: } (1296 + 486\pi) \times 30 = 84684.42 \text{ g}$$

$$10 \text{ kg} = 10000 \text{ g}$$

$$\text{bags needed: } 84684.42 \div 10000 = 8.47$$

9 bags

$$\text{cost: } 9 \times 15.8 = 142.2$$

£ 142.20 [6]

- 11 (a) The length,  $d$ , of Jamal's car is 4.72 m, correct to 2 decimal places.

Complete the error interval for the length,  $d$ .

$$(a) \dots 4.715 \dots \leq d < \dots 4.725 \dots [2]$$

- (b) Jamal travels 430 km, correct to the nearest 10 km.  
His average speed is 57.3 km/h, correct to 1 decimal place.

Calculate the shortest possible time for Jamal's journey.  
Give your answer correct to the nearest minute.

$$\begin{aligned} \text{distance} &= 430 \text{ km} && \text{lower bound: } 425 \\ \text{speed} &= 57.3 \text{ km/h} && \text{upper bound: } 57.35 \end{aligned}$$



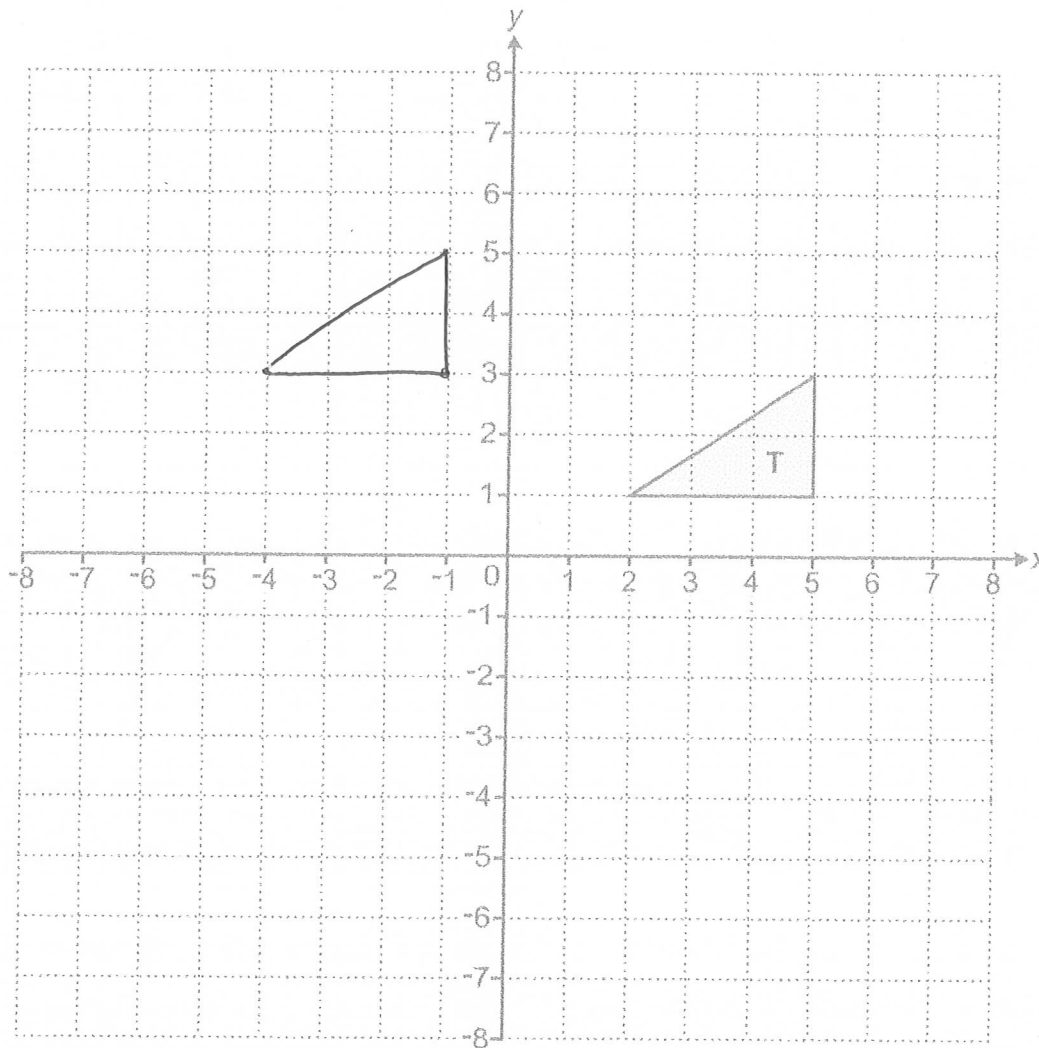
$$T = \frac{D}{S} = \frac{425}{57.35} = 7.41\dots$$

$$0.41\dots \text{ hours} = 24.638\dots \text{ minutes}$$

$\xrightarrow{\quad \quad \quad}$   
 $\times 60$

$$(b) \dots 7 \dots \text{ hours } \dots 25 \dots \text{ minutes } [5]$$

12 Triangle T is drawn on a coordinate grid.



(a) Translate triangle T by vector  $\begin{pmatrix} -6 \\ 2 \end{pmatrix}$ .

[2]

(b) Describe fully the **single** transformation that is equivalent to:

- a reflection in the line  $y = x$ , followed by
- a reflection in the x-axis.

You may use the grid above to help you.

rotation centred at (0,0), 90° clockwise

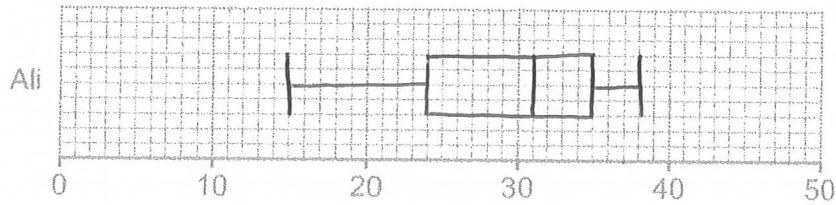
[3]

13 Ali and Beth take it in turns to play a computer game. On each turn, the player achieves a score out of 50. Ali and Beth play the computer game many times and record their scores.

(a) Ali's scores are summarised below.

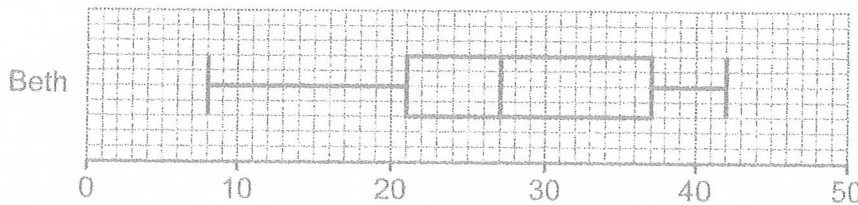
- median = 31
- highest score = 38
- range = 23
- lower quartile = 24
- interquartile range = 11

Draw a box plot to show the distribution of Ali's scores.



[3]

(b) This box plot shows the distribution of Beth's scores.



Find the interquartile range of Beth's scores.

$37 - 21$

(b) ..... 16 ..... [2]

(c) Kareem says

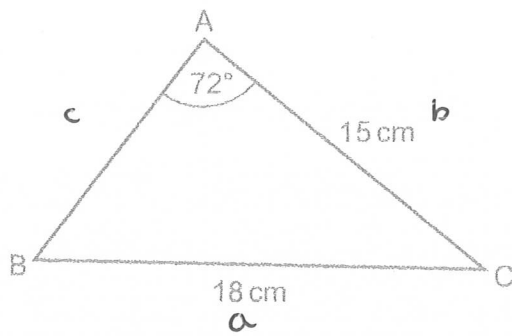
Beth was more consistent than Ali because Beth had a lower median score.

Is his statement correct?  
Explain your reasoning.

..... No because consistency is measured by range.....  
..... Beth's range is higher so less consistent.....

[2]

14 The diagram shows triangle ABC.



Not to scale

AC = 15 cm, BC = 18 cm and angle BAC = 72°.

Calculate length AB, giving your answer correct to 3 significant figures.  
Show your working.

$$\frac{\sin B}{15} = \frac{\sin 72}{18} \rightarrow \sin B = \frac{15 \sin 72}{18} \rightarrow B = \sin^{-1} \left( \frac{15 \sin 72}{18} \right)$$

$$B = 52.424\dots$$

$$C = 180 - 72 - 52.424\dots = 55.5758\dots$$

$$\frac{c}{\sin(55.5758\dots)} = \frac{18}{\sin 72}$$

$$c = \frac{18 \sin(55.578\dots)}{\sin 72} = 15.61184765$$

15.6

..... cm [6]

15 Here are two pieces of work.

For each one, describe the error made and give the complete correct solution.

(a)

Question:

Solve by factorisation.

$$3x^2 - 2x - 5 = 0$$

Solution:

$$(3x + 5)(x - 1) = 0$$

Therefore  $x = -5/3$  or  $x = 1$

Error: ... when the brackets are expanded out, the factors give  $+2x$ , but  $-2x$  is needed

Correct solution:  $(3x - 5)(x + 1) = 0$

$$x = \frac{5}{3} \quad x = -1$$

[3]

(b)

Question:

Solve, giving your answers correct to 3 significant figures.

$$2x^2 - 8x + 3 = 0$$

Solution:

$$x = -(-8) \pm \frac{\sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$$

Therefore  $x = 6.42$  or  $x = 9.58$ 

Error: the  $-(-8)$  term should be inside the numerator

Correct solution:

$$x = \frac{-(-8) \pm \sqrt{(-8)^2 - 4 \times 2 \times 3}}{2 \times 2}$$

$$x = 0.419 \text{ and } 3.58$$

[3]

- 16  $y$  is inversely proportional to the square of  $x$ .  
 $y = 2$  when  $x = 5$ .

Find a formula linking  $x$  and  $y$ .

$$y = \frac{k}{x^2} \quad \rightarrow \quad 2 = \frac{k}{5^2} \quad \rightarrow \quad k = 50$$

$$y = \frac{50}{x^2} \dots \dots \dots [3]$$

- 17 Expand and simplify.

$$(x+1)(x-1)(x+2)$$

$$(x^2 - x + x - 1)(x+2)$$

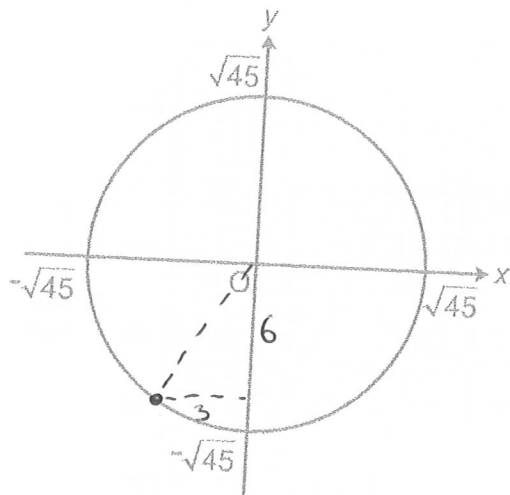
$$(x^2 - 1)(x+2)$$

$$x^3 - x + 2x^2 - 2$$

$$x^3 + 2x^2 - x - 2 \dots \dots \dots [3]$$



- 18 Here is a sketch of the circle  $x^2 + y^2 = 45$ .



- (a) Show that the tangent to this circle at the point  $(-3, 6)$  has a gradient of  $\frac{1}{2}$ . [2]

gradient of radius:  $\frac{6}{-3} = -2$

gradient of tangent:  $\frac{1}{2}$   
(negative reciprocal)

- (b) Find the equation of the tangent at the point  $(-3, 6)$ .

$$y = \frac{1}{2}x + c \rightarrow 6 = -\frac{3}{2} + c \rightarrow c = \frac{15}{2}$$

(b)  $y = \frac{1}{2}x + \frac{15}{2}$  [2]

20 Solve.

$$\begin{aligned}x^2 + y^2 &= 34 \\ y &= x + 2\end{aligned}$$

Show your working.

$$x^2 + (x + 2)^2 = 34$$

$$x^2 + x^2 + 4x + 4 = 34$$

$$2x^2 + 4x - 30 = 0$$

$$x^2 + 2x - 15 = 0$$

$$(x + 5)(x - 3) = 0$$

$$x = -5 \quad x = 3$$

$$y = -5 + 2 = -3$$

$$y = 3 + 2 = 5$$

$$x = \dots -5 \dots \quad y = \dots -3 \dots$$

$$x = \dots 3 \dots \quad y = \dots 5 \dots \quad [6]$$

END OF QUESTION PAPER

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**ADDITIONAL ANSWER SPACE**

If you need extra space use the following lined pages. The question numbers must be clearly shown.

A large rectangular area with horizontal dotted lines for writing answers. A vertical solid line is on the left side, and a horizontal solid line is at the top of the area.



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