

## GCSE (9–1) Mathematics

J560/05 Paper 5 (Higher Tier)

**Monday 6 November 2017 – Morning**

**Time allowed: 1 hour 30 minutes**



**You may use:**

- Geometrical instruments
- Tracing paper

**Do not use:**

- A calculator



First name										
Last name										
Centre number										
Candidate number										

### INSTRUCTIONS

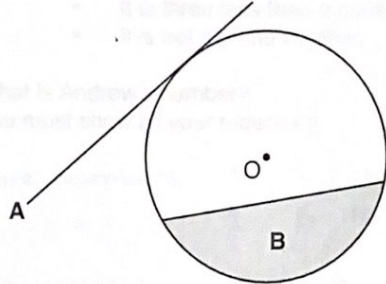
- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Read each question carefully before you start to write your answer.
- Where appropriate, your answers should be supported with working. Marks may be given for a correct method even if the answer is incorrect.
- Write your answer to each question in the space provided.
- If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the barcodes.

### INFORMATION

- The total mark for this paper is **100**.
- The marks for each question are shown in brackets [ ].
- This document consists of **16** pages.

Answer **all** the questions.

- 1 The diagram shows a circle, centre O.



Write down the mathematical name of

- (a) line A,

(a) ..... *Tangent* ..... [1]

- (b) shaded region B.

(b) ..... *Segment* ..... [1]

- 2 (a) Write the next term in each of these sequences.

(i) 1    1    2    3    5    8

(a)(i) ..... *13* ..... [1]

(ii) 2    4    8    16    32    64

(ii) ..... *128* ..... [1]

- (b) Write an expression for the  $n$ th term of the sequence below.

15    12    9    6

(b) .....  *$18 - 3n$*  ..... [2]

3 Andrew is thinking of a number.

- It is between 1 and 150.
- It is one more than a square number.
- It is three less than a cube number.
- It is not a prime number.

What is Andrew's number?

You must show all your reasoning.

Square numbers: 1 4 9 16 25 36 49 64 81 100 121 144  
 + 1            2 5 10 17 26 37 50 65 82 101 122 145  
 not prime:    10 26 50 65 82 122 145  
 cube numbers: 1 8 27 64 125

So number is 122

$$\text{as } 122 = 11^2 + 1 = 5^3 - 3$$

and 122 is not prime.

..... 122 ..... [4]

4 (a) Factorise.

$$x^2 - 43^2$$

(a) .....  $(x - 43)(x + 43)$  ..... [1]

(b) Calculate.

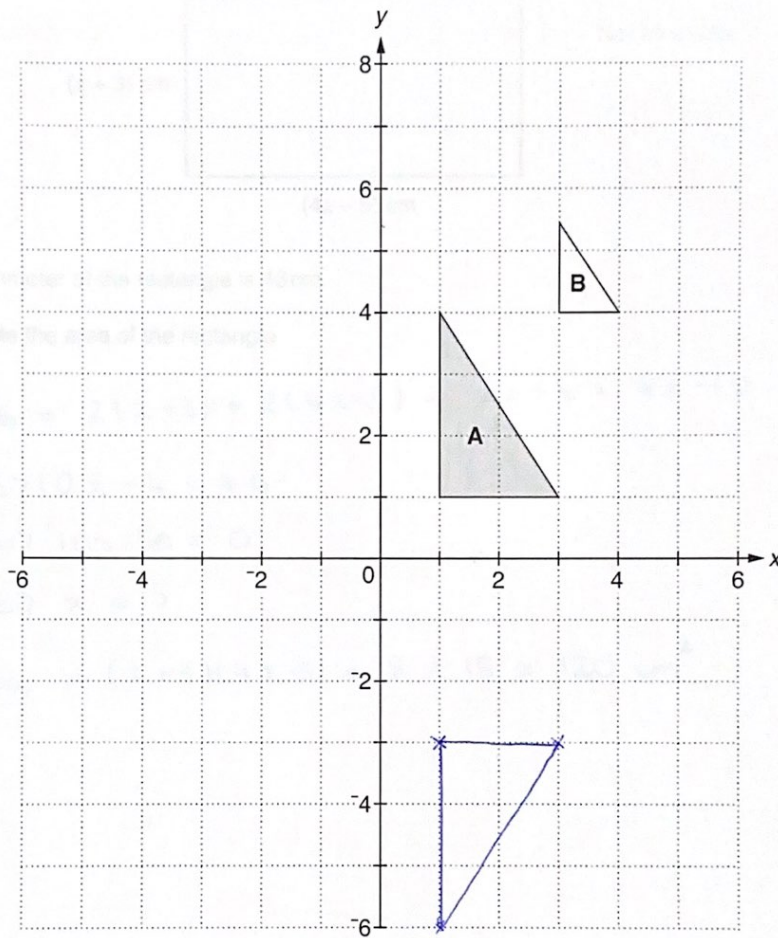
$$57^2 - 43^2$$

$$= (57 - 43)(57 + 43)$$

$$= 14 \times 100 = 1400$$

(b) ..... 1400 ..... [2]

- 5 Here is a coordinate grid.



- (a) Draw the image of triangle **A** after a reflection in the line  $y = -1$ . [2]

- (b) Describe fully the **single** transformation that maps triangle **A** onto triangle **B**.

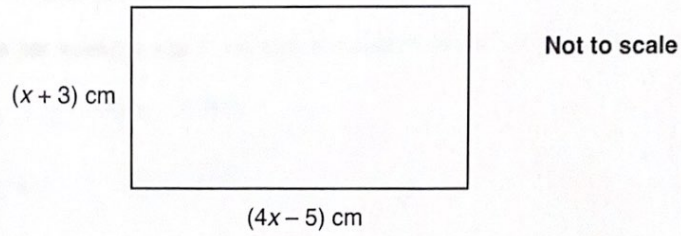
Enlargement by scale factor  $\frac{1}{2}$ , centre  $(5, 7)$ .  
 ..... [3]

- (c) Complete this statement.

A rotation of  $180^\circ$  around  $(0, 0)$  has the same effect as an enlargement by  
 scale factor  $-1$  with centre of enlargement  $(\dots, \dots)$ . [2]

5

- 6 This rectangle has length  $(4x - 5)$  cm and width  $(x + 3)$  cm.



The perimeter of the rectangle is 46 cm.

Calculate the area of the rectangle.

$$46 = 2(x+3) + 2(4x-5) = 2x+6 + 8x-10$$

$$\Rightarrow 10x - 4 = 46$$

$$\Rightarrow 10x - 50 = 0$$

$$\Rightarrow x = 5$$

$$\text{Area} = (x+3)(4x-5) = 8 \times 15 = 120 \text{ cm}^2$$

..... 120 ..... cm<sup>2</sup> [5]

- 7 Naomi is given a 10% pay decrease.  
Her new wage is £252 per week.

What would be her weekly wage if, instead, she had received a 10% pay increase?

$$252 \div 0.9 = 280$$

$$280 \times 1.1 = 308$$

£ 308 ..... [5]

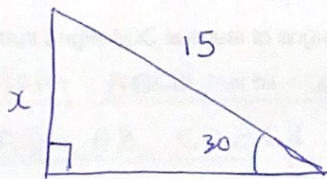
- 8 The angles in a triangle are in the ratio 1 : 2 : 3.

(a) Show that the triangle is a right-angled triangle. [2]

$$180 \div (1+2+3) \times 3 = 90$$

(b) The hypotenuse of the triangle is 15 cm long.

Calculate the length of the shortest side in the triangle.



$$90 \div 3 = 30$$

$$\sin 30 = \frac{x}{15}$$

$$x = 15 \sin 30 = 7.5$$

(b) 7.5 ..... cm [4]

- 9 There is a total of 250 men, women and children on a train.  
The ratio of men to women is 4 : 5.  
The ratio of women to children is 10 : 7.

How many men are on the train?

$$\text{ratio} = 8 : 10 : 7$$

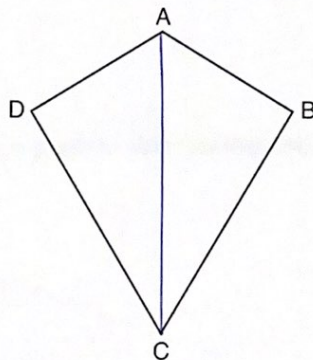
$$250 \div 25 = \frac{125}{10} \times 10$$

$$8 \times 10 = 80$$

80

[4]

- 10 ABCD is a quadrilateral.  
AD = AB and CD = CB.



Not to scale

Prove that angle ADC is equal to angle ABC.

Split ABCD into 2 triangles, ADC and ABC.

AD = AB, CD = CB and AC is common.

So  $\triangle ADC$  and  $\triangle ABC$  are congruent by SSS.

Hence  $\angle ADC = \angle ABC$ .

[4]

- 11 Amelia buys a new car.  
The expected future value of this car, £ $V$ , is given by

$$V = 16000 \times 0.75^t$$

where  $t$  is the age of the car in complete years.

- (a) (i) Write down the value of the car when new.

(i) £ ..... 16 000 ..... [1]

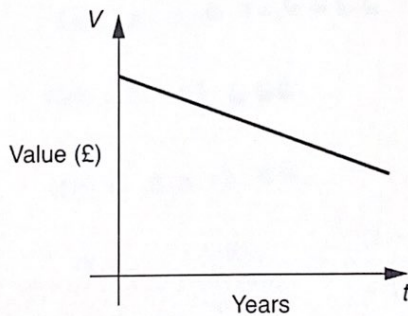
- (ii) Write down the annual percentage decrease in the expected value of the car.

(ii) ..... 25 ..... % [1]

- (iii) Show that the expected value of the car when 2 years old is £9000. [2]

$$16000 \times 0.75^2 = 9000$$

- (b) Amelia sketches a graph to show the expected value of her car as it gets older.



Explain how you know that Amelia's graph is incorrect.

..... The equation does not give a straight line. ....  
 ..... [1]



- (c) Amelia assumes that her car will have no value at all after 20 years.

Explain why her assumption is mathematically incorrect.

$$16\,000 \times 0.75^{20} > 0$$

[1]

- 12 (a) Write  $\frac{5}{6}$  as a recurring decimal.

$$0.833$$

$$6 \overline{) 5.50000}$$

(a) .....  $0.8\bar{3}$  ..... [2]

- (b) Convert  $0.12\bar{6}$  to a fraction.  
Give your answer in its lowest terms.

$$\text{Let } x = 0.126666\dots$$

$$100x = 12.666\dots$$

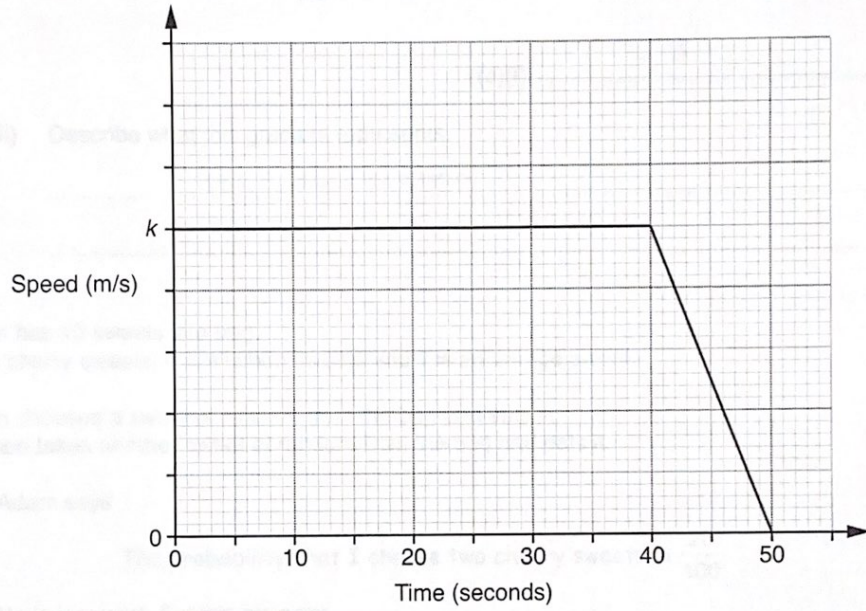
$$100x - x = 12.54$$

$$x = \frac{12.54}{99} = \frac{1254}{9900} = \frac{19}{150}$$

$$\frac{19}{150}$$

(b) ..... [3]

- 13 The graph shows information about the speed of a vehicle during the final 50 seconds of a journey. At the start of the 50 seconds the speed is  $k$  metres per second. The distance travelled during the 50 seconds is 1.35 kilometres.



- (a) Work out the average speed of the vehicle during the 50 seconds. Give your answer in metres per second.

$$1350 = 40k + \left(\frac{1}{2} \times 10k\right)$$

$$1350 \div 50 = 27$$

$$1350 = 45k$$

$$k = 30$$

(a) ..... 27 ..... m/s [2]

- (b) Work out the value of  $k$ .

(b)  $k =$  ..... 30 ..... [5]

- (c) (i) Calculate the gradient of the graph in the final 10 seconds of the journey.

$$-\frac{30}{10} = -3$$

(c)(i) ..... - 3 ..... [1]

- (ii) Describe what this gradient represents.

The deceleration.

..... [2]

- 14 Adam has 10 sweets in a bag.  
5 are cherry sweets, 4 are lemon sweets and 1 is an orange sweet.

Adam chooses a sweet at random from the bag and eats it.  
He then takes another sweet at random from the bag and eats it.

- (a) Adam says

The probability that I choose two cherry sweets is  $\frac{25}{100}$ .

He is incorrect. Explain his error.

He didn't account for him eating the  
sweet.

..... [2]

- (b) Find the probability that the two sweets he chooses have different flavours.

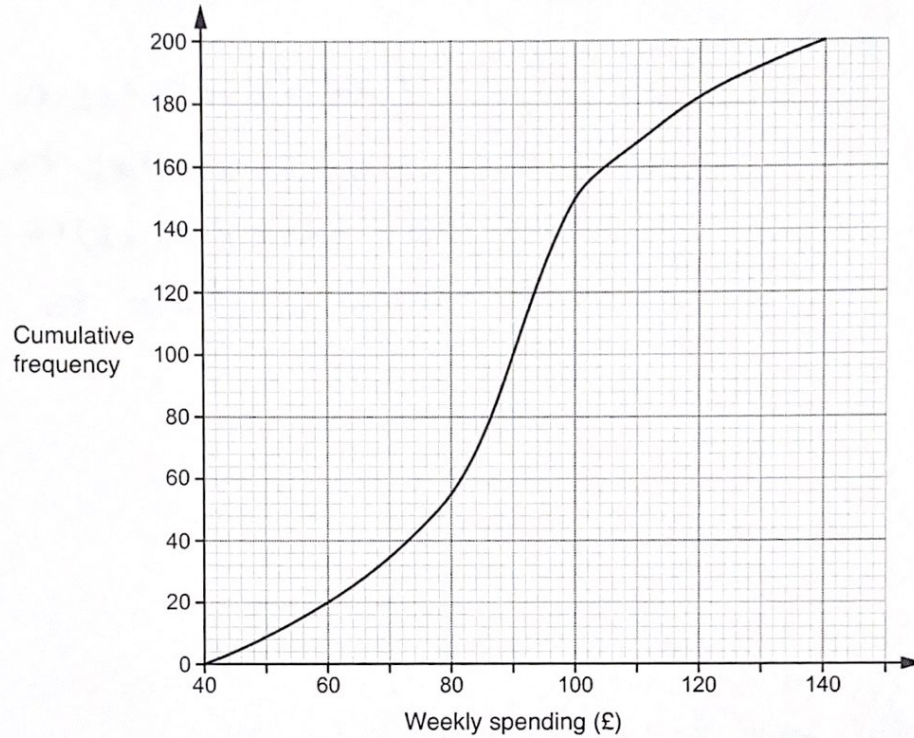
$$\frac{5}{10} \times \frac{5}{9} = \frac{25}{90}, \quad \frac{4}{10} \times \frac{6}{9} = \frac{24}{90},$$

$$\frac{1}{10} \times \frac{9}{9} = \frac{1}{10}$$

$$\frac{25}{90} + \frac{24}{90} + \frac{9}{90} = \frac{58}{90}$$

(b) .....  $\frac{29}{45}$  ..... [4]

- 15 Iqrah carries out a survey of 200 families in the **north** of England on their weekly spending on food.  
The cumulative frequency diagram summarises the results.



(a) Find

(i) the median,

(a)(i) £ ..... 90 ..... [1]

(ii) the interquartile range.

$$UQ = 100$$

$$LQ = 78$$

$$IQR = 100 - 78 = 22$$

(ii) £ ..... 22 ..... [2]

(b) Iqrah says

15% of these families spent over £120.

Is her statement correct?

State the evidence you have used in making your decision.

NO,  $\frac{187}{200}$  spent less than £120, so 9% actually  
 spent over £120. [2]

(c) In a survey of 200 families in the **south** of England, the median weekly amount spent on food was £84 and the interquartile range was £28.

Make two comparisons between the weekly amounts spent on food in the north of England and the south of England.

State the evidence you have used in making your comparisons.

1 Families in the south spent less on average, as  
 their median was lower. [2]

2 Families in the south were more spread in their  
 spending as their IQR was larger. [2]

16 (a) Write  $\sqrt{12} + \sqrt{75}$  in the form  $k\sqrt{3}$ .

$$\begin{aligned}\sqrt{12} + \sqrt{75} &= 2\sqrt{3} + 5\sqrt{3} \\ &= 7\sqrt{3}\end{aligned}$$

(a)  $7\sqrt{3}$  [3]

(b) Work out.

$$\begin{aligned}16^{-\frac{3}{4}} &= \left(\sqrt[4]{16}\right)^{-3} = \frac{1}{2^3} = \frac{1}{8}\end{aligned}$$

(b)  $\frac{1}{8}$  [3]

17 Solve the inequality.

$$x^2 - 5x - 6 \leq 0$$

$$\Rightarrow (x - 6)(x + 1) \leq 0$$

$$\Rightarrow -1 \leq x \leq 6$$

$$-1 \leq x \leq 6$$

[4]

18 Prove that the difference between two consecutive square numbers is always odd. [4]

Given that  $x$  is an integer.

$$(x+1)^2 - x^2 = x^2 + 2x + 1 - x^2 = \cancel{x^2} + 2x + 1$$

and  $2x + 1$  is always odd.

19 Solve these simultaneous equations algebraically.

$$\begin{aligned}y &= 2x^2 - 7x + 4 \\ y &= 4x - 1\end{aligned}$$

$$\Rightarrow 2x^2 - 7x + 4 = 4x - 1$$

$$\Rightarrow 2x^2 - 11x + 5 = 0$$

$$\Rightarrow (2x - 1)(x - 5) = 0$$

$$\Rightarrow x = \frac{1}{2} \text{ or } x = 5$$

$$\begin{aligned}x &= \frac{1}{2} \dots\dots\dots y = 1 \dots\dots\dots \\ x &= 5 \dots\dots\dots y = 19 \dots\dots\dots [6]\end{aligned}$$

END OF QUESTION PAPER

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