Qualification Accredited

Oxford Cambridge and RSA

GCSE (9-1)

Examiners' report

MATHEMATICS

J560

For first teaching in 2015

J560/05 November 2018 series

Version 1

Contents

Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

Paper J560/05 series overview

This non-calculator paper is the second of the three papers taken by higher tier candidates for the GCSE (9-1) Mathematics specification.

The entry for this November resit was much smaller than the entry for the June 2018 session. A few more able candidates were entered for the examination with the aim of trying to achieve the highest grade but the majority of candidates were aiming for a pass or good pass.

The majority found many of the questions accessible and showed working where appropriate, and work in general showed improvement compared to the November 2017 examination.

The most successful topics/areas included standard form, completing a probability table, density, using ratio in context, drawing time series graphs, drawing transformations, and problem solving with percentage change.

The least successful topics/areas included problems involving sectors, trigonometry, regions and inequalities, sequences, problems involving area and similar shapes.

Question 1(a)

1 Work out.

(a) $\sqrt[3]{64} \times 2^{-1}$

(a) .... **[2]**

Candidates often scored 1 mark on this question for showing that the cube root of 64 was 4. Fewer candidates were able to deal with the negative index which was often interpreted as $^-2$.

Question 1(b)

(b) $4.3 \times 10^5 + 3.8 \times 10^4$
Give your answer in standard form.

(b) .... **[3]**

Many candidates were successful with the calculation and either changed both values to ordinary numbers before adding and converting back to standard form or made adjustments to one of the standard form values to ensure that the powers were the same before adding. Others incorrectly added 4.3 and 3.8 without any adjustment for the powers.

Question 2

2 By writing each number correct to 1 significant figure, find an estimate for this calculation.

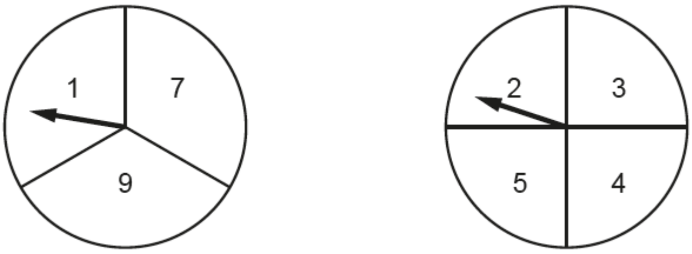
$$\frac{606.3 \times 0.312}{19.93}$$

.... **[3]**

Only a few candidates scored full marks on this question. Errors included incorrect rounding, with 606 often used in the calculation rather than values rounded to one significant figure as instructed. A few others incorrectly rounded to 6, 0.3 and 2.

Question 3(a)

3 Geoff has two fair spinners.



Spinner A Spinner B

He spins both spinners and **multiplies** the numbers on each spinner.

(a) Complete the table.

Spinner A

	×	1	7	9
Spinner B	2	2	14	18
	3	3	21	27
	4	4	28	
	5	5	35	

[1]

Almost all candidates scored this mark. A few made errors in the multiplication and a few added the values on spinner A and spinner B.

Question 3(b)

(b) Geoff wants to work out the probability that the outcome of the multiplication is an even number or a prime number.
Here is his working.

> The probability the outcome is an even number is $\frac{6}{12}$.
>
> The probability the outcome is a prime number is $\frac{3}{12}$.
>
> The probability the outcome is an even number or a prime number is $\frac{6}{12}+\frac{3}{12}=\frac{9}{12}$.

Geoff is wrong.
Explain his error and give the correct answer.

....

.... **[2]**

Many candidates were able to give the correct probability of $\frac{8}{12}$. Fewer were able to correctly explain Geoff's error by referring to the value 2 being both prime and even.

A common error was to say that there were only 2 prime numbers or to say that the two probabilities should have been multiplied.

Question 4

4 A solid metal block has mass 500 g and volume 125 cm^3.

Work out the density of the block.
Give the units of your answer.

.... **[3]**

This was generally well answered. Many candidates also gave the correct units.

Errors included dividing the volume by the mass and giving the units as cm^3/g.

Question 5(a)

5 The depth of water in a garden pond is 57.8 cm.
The depth decreases by 0.3 cm per day.

(a) Assume the depth continues to decrease at the same rate.

After how many days will the depth reach 54.2 cm?

(a) .... days **[3]**

Candidates answered this well and showed clear working. A few chose the longer method of repeatedly subtracting 0.3 from 57.8 to reach 54.2 and occasionally gave the answer 13 by counting the starting value of 57.8 and the final value of 54.2 in the repeated steps.

Question 5(b)

(b) If the depth of water decreases at a slower rate, what effect will this have on your answer to part **(a)**?

.... **[1]**

Almost all candidates were able to state that this would cause the answer to part (a) to be bigger.

Question 6

6 Sally has 30 feet of ribbon.

She cuts strips each of length $2\frac{2}{5}$ feet from the ribbon.

Sally says

I can cut 13 of these strips from this ribbon.

Is she correct?
Show how you decide.

.... **[4]**

Most candidates approached this in one of two ways. Some attempted to divide 30 by $2\frac{2}{5}$ and show that only 12 strips could be cut. Others multiplied $2\frac{2}{5}$ by 13 and showed that the result exceeded 30 feet.

The problem was set with fractions, but those candidates that converted $2\frac{2}{5}$ to 2.4 and then used a decimal calculation were given full credit when the answer was calculated correctly.

A number of candidates did not have a strategy for approaching the initial problem.

Question 7

7 Emily spent £2400 on holiday in 2017.
This was 20% more than she spent on holiday in 2016.

Calculate the amount she spent on holiday in 2016.

£ .... **[3]**

Responses to this reverse percentage question were very mixed. A number of candidates recognised that the original value needed to be calculated and divided by a multiplier of 1.2 or equivalent to obtain the correct answer. Others used trial and improvement, often successfully. Some gained credit for recognising that £2400 represented 120% even if they could not make further progress.

Many did not recognise the reverse aspect and made the common error of finding 80% of £2400.

Exemplar 1 3 marks

7 Emily spent £2400 on holiday in 2017.
This was 20% more than she spent on holiday in 2016.

Calculate the amount she spent on holiday in 2016.

120% = £2400
÷ 120% ÷ 120
1% = 20
x100 x100
100% = £2000

$120\overline{)2400}$ 20

240 ÷ 2
120 ÷ 1
1200 ÷ 10
2400 ÷ 20

£ 2000 [3]

This candidate provides a model answer to this problem showing each stage clearly and accurately.

Exemplar 2 1 mark

7 Emily spent £2400 on holiday in 2017.
This was 20% more than she spent on holiday in 2016.

Calculate the amount she spent on holiday in 2016.

120% = £2400
÷ 12% ÷ 12
10% = 200
x100 x100
100% ~~200,000~~ = 20,000

12
24
24 ÷ 12 = 200
2016 = 20,000

£ 20,000 [3]

This candidate starts well and makes the correct association that £2400 is 120% of the original amount but then, after correctly finding 10%, an error is made in multiplying by 100. This scores M1 for a correct association.

Exemplar 3 — 0 marks

Calculate the amount she spent on holiday in 2016.

2400 x 0.20

1,920

10% = 240

20% = 480

2400 − 480

£ 1920 [3]

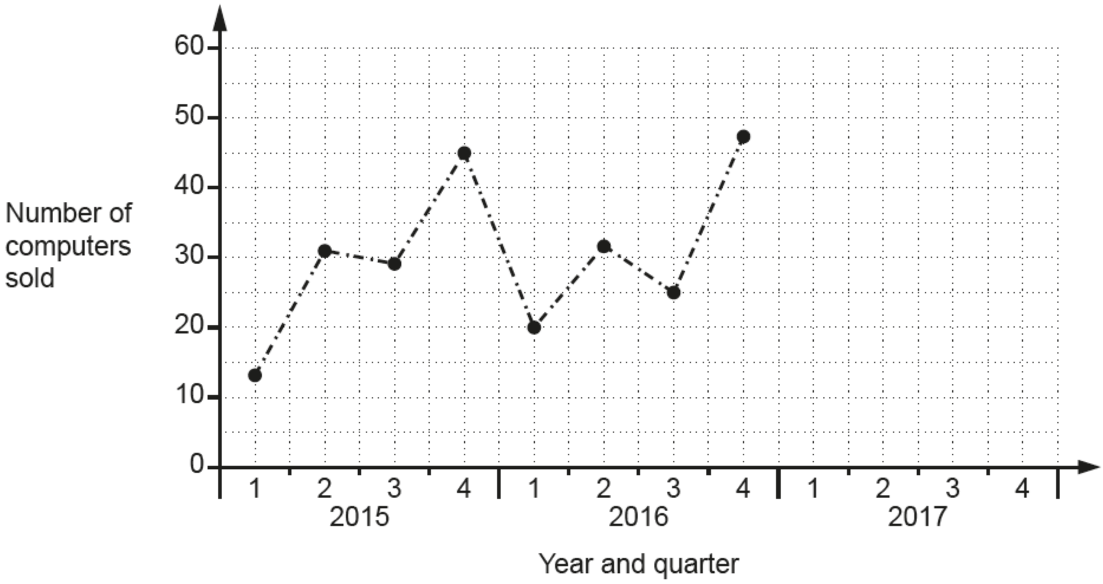
This candidate makes the very common error of finding 80% of £2400 and scores no marks.

Question 8(a)

8 The table shows the number of computers sold in Tom's shop each quarter from 2015 to 2017.

	2015				**2016**				**2017**			
Quarter	1	2	3	4	1	2	3	4	1	2	3	4
Number of computers sold	13	31	29	45	20	32	25	47	27	40	30	58

(a) Complete this graph using the information for 2017.



[2]

This question was well answered. A few candidates plotted points in the incorrect positions horizontally.

Question 8(b)

(b) Tom adds the three results for quarter 1 and he adds the three results for quarter 4.
Tom says

The ratio of the **total** number of computers sold in quarter 1 compared to quarter 4 is 2 : 5.

Is he correct?
Show your reasoning.

.... **[2]**

This question was generally well answered. Candidates often showed the correct addition of values resulting in totals of 60 and 150 and then confirmed that Tom was correct. Some gave the correct values but then did not comment on whether Tom was correct and scored 1 mark only.

A few candidates gave only one of the correct additions/totals.

Question 8(c)

(c) Make two comments about Tom's sales over the period 2015 to 2017.

Comment 1 ....

....

Comment 2 ....

.... **[2]**

Two types of comments were expected here; one that referred to any seasonal trends and one that referred to an overall trend. Most candidates were successful with one of these comments but then often made a similar comment about the same aspect with their second comment. Only a few gave a correct seasonal comment and a correct overall comment.

Exemplar 1 — 2 marks

(c) Make two comments about Tom's sales over the period 2015 to 2017.

Comment 1 The trend is that the sales are increasing over this period of 3 years

Comment 2 In each year ~~most~~ the 4th quarter has the greatest number of sales. **[2]**

This candidate gives two reasons and ensures that one of them concerns seasonal variation while the other concerns the overall trend. Both marks were credited.

Exemplar 2 — 1 mark

(c) Make two comments about Tom's sales over the period 2015 to 2017.

Comment 1 In quater 4, he sells the most computers

Comment 2 In quater 1, his sales are the lowest. **[2]**

This candidate gives two reasons but both refer to seasonal variations which was very common. Only 1 mark was credited.

Question 8(d)

(d) Tom predicts that he will sell more than 60 computers in the 4^{th} quarter of 2018.

What assumption has he made?

....

.... **[1]**

Candidates were expected to refer to Tom assuming that the increasing sales trend would continue. Many did this but some gave vague or irrelevant answers that did not refer to an assumption.

Question 9

9 Rearrange this formula to make y the subject.

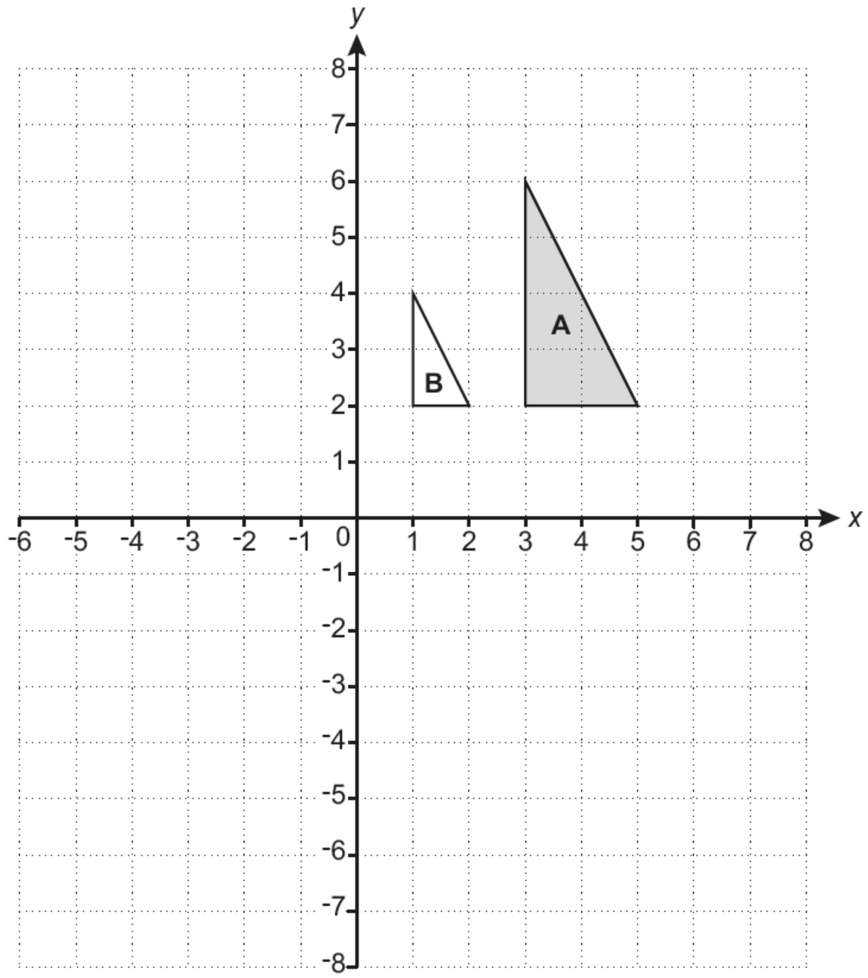
$$x = y^2 + 7$$

.... **[2]**

Many were successful in rearranging the formula but there were a number of candidates that added 7 as their first step and others that squared or divided by 2 in their second step.

Question 10(a)(i)

10 Triangle **A** and triangle **B** are drawn on the coordinate grid.



(a) **(i)** Draw the image of triangle **A** after a rotation of 180° about (0, 0). **[2]**

This question was well answered. Some candidates rotated triangle **A** 180° about an incorrect centre however.

Question 10(a)(ii)

(ii) Draw the image of triangle **A** after a translation by the vector $\begin{pmatrix} 2 \\ -7 \end{pmatrix}$. **[2]**

This question was well answered. A few candidates were unable to interpret the vector correctly but almost all attempted a translation.

Question 10(b)

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

....

.... **[3]**

Answers to this question were mixed. Enlargement was often given but some were confused by the fact that the shape had been made smaller and incorrectly gave answers such as reduction with a scale factor 'divide by 2' instead of 0.5.

The centre of enlargement was often incorrect or not considered at all.

Exemplar 1 — 3 marks

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

Enlargement, scale factor 1/2

centre of enlargement = (−1, 2) **[3]**

This candidate gives a model answer using the correct terminology and including all of the required features.

Exemplar 2 — 0 marks

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

Decreased size by S.F 2 $\begin{pmatrix}0\\-2\end{pmatrix}$

.... **[3]**

This candidate uses incorrect terminology for enlargement and is unfamiliar with the concept that an enlargement by a fractional scale factor can make the object shape smaller.

Question 11

11 The price of a washing machine is reduced by 20% for a sale.
Afterwards, the sale price is increased by 30%.

Joachim says

The washing machine is now 10% more expensive than before the sale.

Explain Joachim's error and work out the correct percentage change in the price of the washing machine from before the sale to after the sale.

Joachim's error is ....

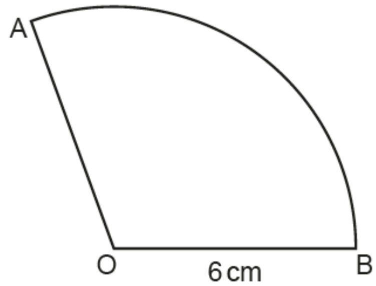
....

Correct percentage change is .... % **[6]**

There were some excellent answers to this question. Most candidates used the strategy of working through the problem with a chosen value for the price of the washing machine; those that used a sensible value, such as £100, were usually successful in interpreting the overall percentage increase although there were sometimes arithmetic errors made. Fewer candidates were successful in explaining Joachim's error. Those that were able to explain the error referred to 20% being subtracted from 30% or that Joachim had calculated 30% of the original price and not the sale price in his calculation.

Question 12

12 AOB is a sector of a circle, centre O and radius 6 cm.
The length of arc AB is 5π cm.



Not to scale

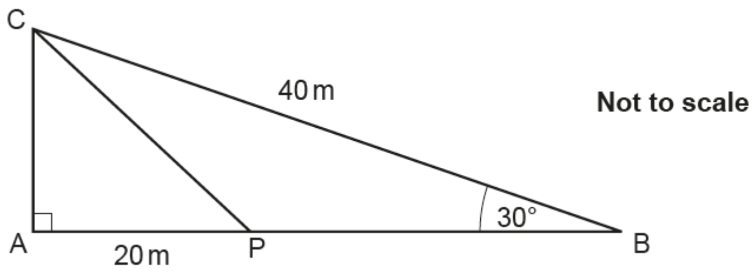
Find the area of the sector.
Give your answer in terms of π.

.... cm^2 **[5]**

Only a few candidates made progress with this question. A few were able to calculate angle AOB using the given arc length and then use it to find the area of the sector. A few others calculated the circumference of the full circle as 12π and then used the given arc length to establish the sector was $\frac{5}{12}$ of the full circle. There was an independent method mark for those that used their angle AOB within an otherwise correct calculation for the area of the sector which was not often credited.

Question 13(a)

13 In the diagram, ABC is a right-angled triangle.
P is a point on AB.
BC = 40 m, AP = 20 m and angle ABC = 30°.



(a) Show that AC = 20 m. **[3]**

This question was not well answered. Many candidates used the information given that AC = 20 in their reasoning and produced circular arguments involving angles and isosceles triangles. Those that set up a correct trigonometric statement about triangle ABC were usually able to correctly complete the reasoning that AC = 20 m.

Question 13(b)

(b) Find the length of PB.
Give your answer in the form $a(\sqrt{3} - b)$, where a and b are integers.

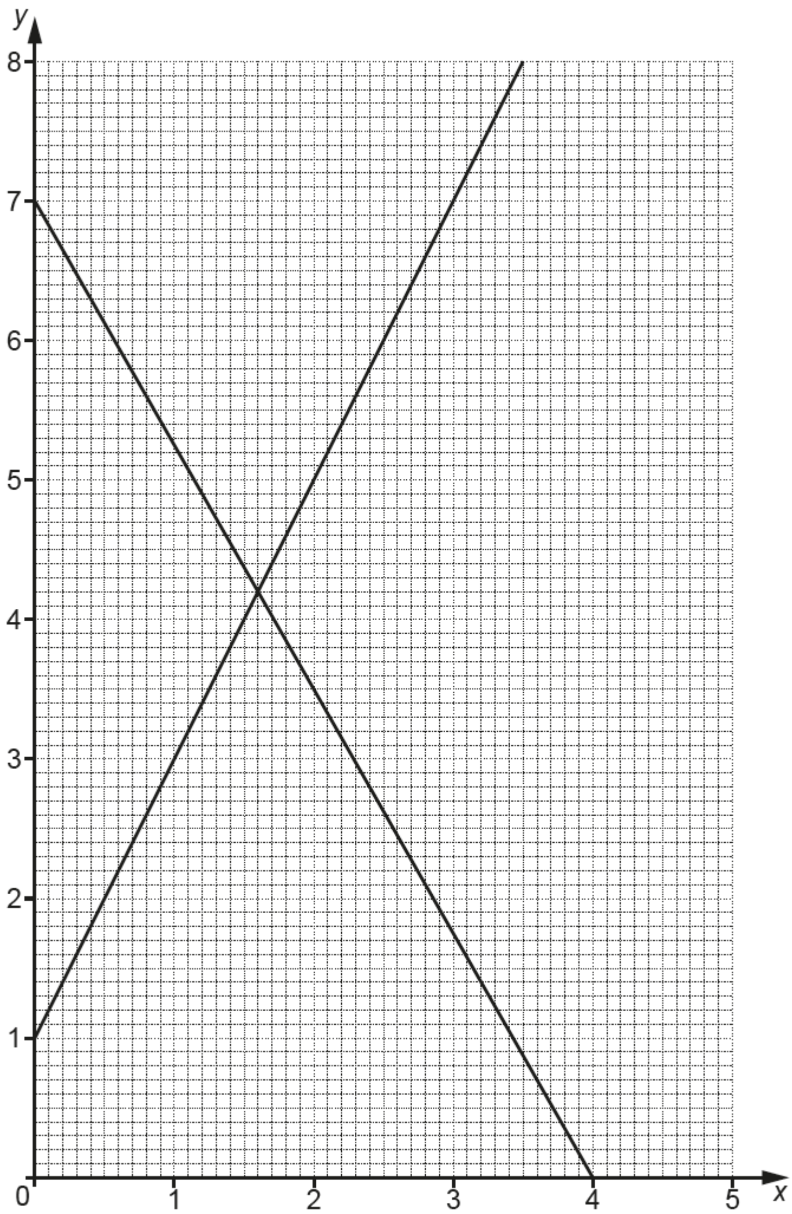
(b) .... **[5]**

Very few candidates attempted to use trigonometry or Pythagoras' to find the length of PB. This part was often omitted.

A few of the more able candidates correctly found the length of AB in surd form with some going on to correctly find the length of PB in the required form.

Question 14

14 The diagram shows the lines $y = 2x + 1$ and $7x + 4y = 28$.



The region R satisfies these inequalities.

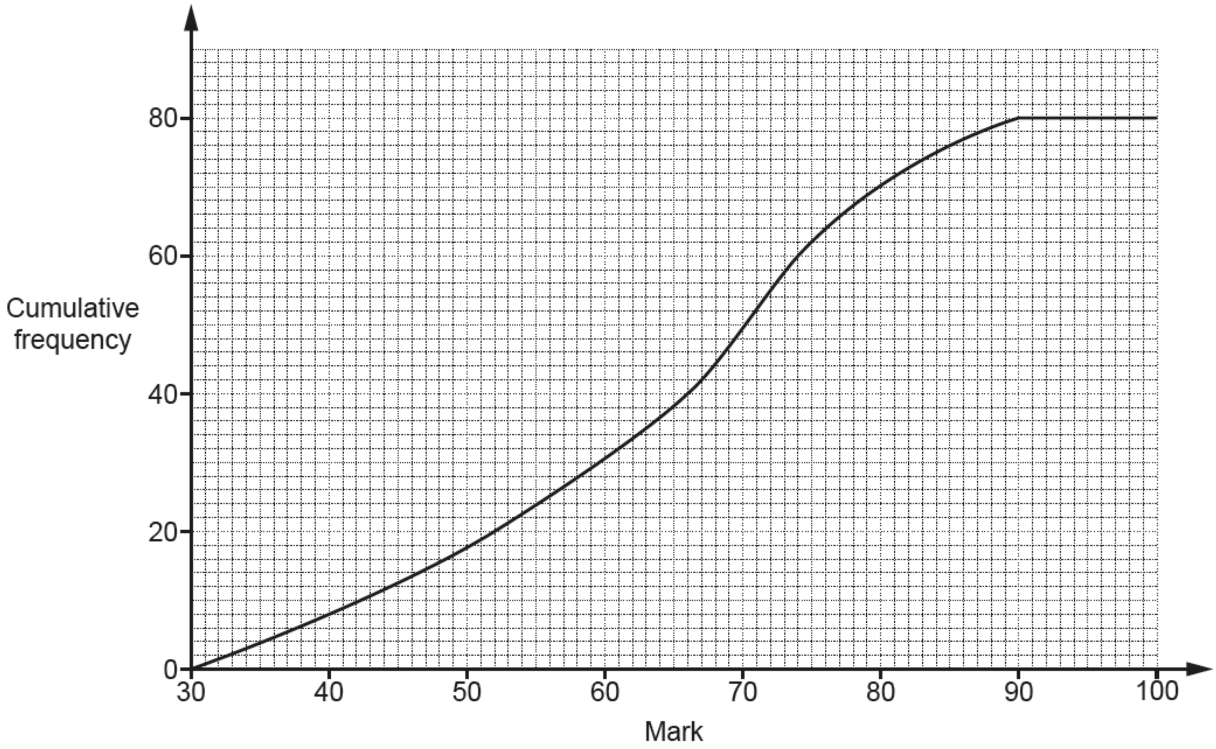
$y \leqslant 2x + 1$ $\qquad$ $7x + 4y \geqslant 28$ $\qquad$ $y > 1$

By drawing a third straight line, find and label the region R that satisfies these inequalities. **[5]**

This question proved difficult for many and was omitted by quite a number of candidates.. The most common error was to draw the line *x* = 1 rather than *y* = 1 for the inequality *y* > 1. Those that drew the correct line often used a solid rather than a broken line for the inequality. Many of the candidates that attempted the question were able to score marks for placing R in a region that satisfied at least one of the inequalities given in the question.

Question 15(a)

15 The cumulative frequency graph shows information about the marks scored by a group of 80 students in a test.



(a) Find the interquartile range.

(a) .... **[2]**

There were mixed responses to this standard question and there is still a lack of familiarity for some candidates with this topic. The most common errors were to give an answer of 40 from 60 – 20 or to do 60 – 20 = 40 and then read the 40th value from the graph.

Question 15(b)

(b) The ratio of the number of students passing the test compared to failing the test is 4 : 1.
Find the minimum mark needed to pass the test.

(b) .... **[3]**

 Turn over

Most candidates dealt with the ratio aspect of the question well and were able to show that 16 students failed the test. Far fewer candidates were able to complete the question correctly to give a correct pass mark from the graph.

Question 16(a)

16 Here is a sequence.

$5 \qquad 5\sqrt{3} \qquad 15 \qquad 15\sqrt{3}$

(a) Work out the next term.

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

Some candidates gave the correct next term (45) for this geometric sequence. A common error was to give an answer of 25.

Question 16(b)

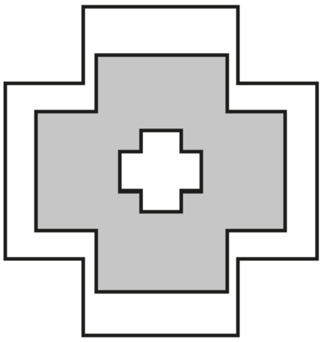
(b) Find the *n*th term.

(b) .... **[3]**

Candidates found this question extremely challenging and marks were seldom credited. Candidates were given credit for each element in their answer provided it was in the correct form.

Question 17

17 The diagram consists of three mathematically similar shapes.
The heights of the shapes are in the ratio 1 : 4 : 5.



Not to scale

Find the ratio

total shaded area : total unshaded area.

Give your answer in its simplest form.

total shaded area : total unshaded area .... : .... **[4]**

This proved to be one of the hardest questions for candidates. Most did not link the similar shapes aspect with areas and used the values 1 : 4 : 5 to arrive incorrectly at a ratio of 4 : 6 = 2 : 3. A few considered that the areas of the shapes were proportional to the squares of the linear relationship and gave 1 : 16 : 25 but then struggled with the next steps of obtaining the proportion shaded (16 – 1) and the proportion unshaded (25 – 16 + 1).

Question 18(a)(i)

18 (a) (i) Write $x^2 + 4x - 16$ in the form $(x + a)^2 - b$.

(a)(i) .... **[3]**

More able candidates found this question reasonably accessible and scored full marks. Some were able to arrive at $(x + 2)^2$ from the quadratic expression but were unable to complete the square. Many others were unfamiliar with the topic and were unable to establish $(x + 2)^2$ as the first step.

Question 18(a)(ii)

(ii) Solve the equation $x^2 + 4x - 16 = 0$.
Give your answers in surd form as simply as possible.

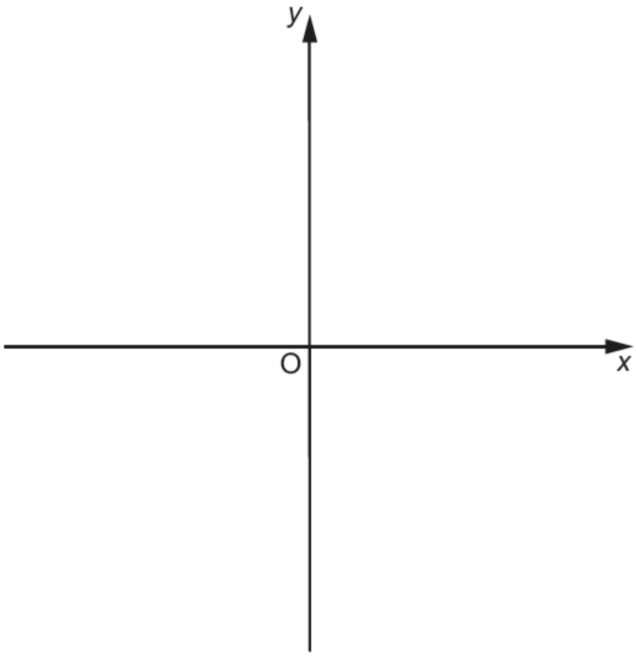
(ii) $x =$ .... or $x =$ .... **[4]**

This question proved challenging for almost all candidates. The intention was to use part (a)(i) to solve the quadratic by completing the square and then simplify the surd in the final answer. Follow through marks were available for those who had done part (a)(i) incorrectly but had an answer in the correct form. A few candidates chose to start from $x^2 + 4x - 16 = 0$ and then use the quadratic formula. Those that recalled the formula correctly usually gained method marks for substitution and partial simplification but usually made errors at the final stage, incorrectly dividing the unsimplified surd $\sqrt{80}$ by 2.

This part was omitted by quite a number of candidates.

Question 18(b)

(b) Sketch the graph of $y = x^2 + 4x - 16$, showing clearly the coordinates of any turning points.



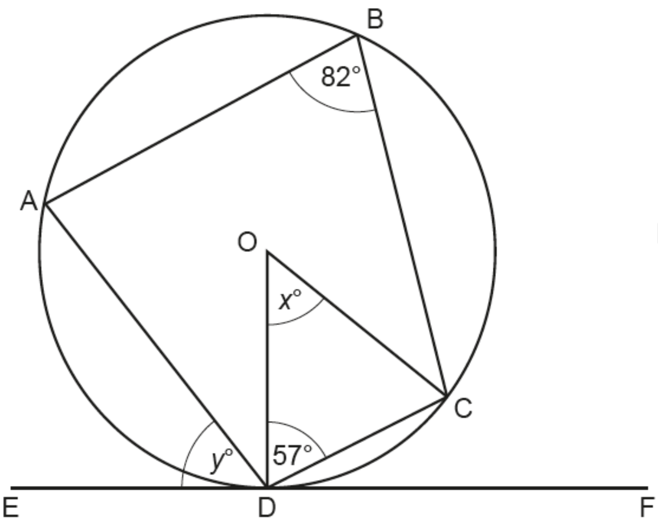
[3]

Candidates found this question part very challenging. Some were able to gain credit by sketching a parabola but were seldom able to give the minimum value of the parabola in the third quadrant as ($^-2$, $^-20$).

Question 19(a)

19 The diagram shows a circle, centre O.

Points A, B, C and D lie on the circumference of the circle.
EDF is a tangent to the circle.
Angle ABC = 82° and angle ODC = 57°.



Not to scale

(a) Work out the value of *x*.

(a) x = ... **[2]**

Many candidates recognised that triangle DOC was isosceles and gave the correct answer. A few made an arithmetic error with the addition and/or the subtraction from 180°.

A number did not recognise OD and OC as radii and made no further progress.

Question 19(b)

(b) Work out the value of y.

(b) $y =$ .... **[3]**

Those candidates that recognised the cyclic quadrilateral ABCD and established that angle ADC was 180 – 82 were successful. A few incorrectly thought that angle ADC = angle ABC = 82 and gave an answer of 25°.

Others found angles around the tangent and radius area such as angle CDF and partial credit was given for those that recognised that the angle between the tangent and the radius OD was 90°.

Question 20(a)

20 (a) Prove that $(2x+1)(3x+2)+x(3x+5)+2$ is a perfect square.

....

....

....

....

.... **[6]**

Most candidates earned marks on this question for correctly expanding brackets. Some made errors in expanding $(2x + 1)(3x + 2)$ with errors such as $6x$ instead of $6x^2$ and 3 instead of 2. Those that correctly expanded both brackets and arrived at $9x^2 + 12x + 4$ often did not realise that this should be factorised to prove it was a perfect square.

Question 20(b)

(b) Gemma says

The equation $(2x+1)(3x+2)+x(3x+5)+2={}^{-}12$ has no solutions.

Explain Gemma's reasoning.

....

.... **[1]**

Very few candidates linked part (a) with this part and the simple explanation that a square could not be negative was not given.

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