Please check the examination details below before entering your candidate information

Candidate surname	Other names

Centre Number | Candidate Number

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

Wednesday 8 November 2023

Morning (Time: 1 hour 30 minutes)

Paper reference **1MA1/1H**

Mathematics

PAPER 1 (Non-Calculator)
Higher Tier

You must have: Ruler graduated in centimetres and millimetres, protractor, pair of compasses, pen, HB pencil, eraser, Formulae Sheet (enclosed). Tracing paper may be used.

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.*
- You must **show all your working**.
- Diagrams are **NOT** accurately drawn, unless otherwise indicated.
- **Calculators may not be used**.

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.
- Try to answer every question.
- Check your answers if you have time at the end.

Turn over ▶

P69533A

Pearson

Please note that these worked solutions have neither been provided nor approved by Pearson Education and may not necessarily constitute the only possible solutions. Please refer to the original mark schemes for full guidance.

Any writing in blue indicates what must be written in order to answer the questions and get the marks. The worked solutions have been designed to show the smallest amount of work which needs to be done to answer the question.

Anything written in green in a cloud doesn't have to be written in the exam.

Anything written in orange in a rectangle doesn't have to be written in the exam and is there to show what should be put into a calculator or measured using a ruler or protractor.

If you find any mistakes or have any requests or suggestions, please send an email to curtis@cgmaths.co.uk

.CG Maths.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Work out 6.3×2.4

63
×24
252
1260
1512

Ignoring the decimals and multiplying 63 and 24

There were 2 decimal places in total in 6.3 and 2.4
so bringing the decimal point 2 times to the left

15.12

(Total for Question 1 is 3 marks)

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2 (a) (i) Write down the value of 5^0

Anything to the power of 0 is 1

1

(1)

(ii) Write down the value of 5^{-2}

$5^2 = 5 \times 5 = 25$ then the negative power means to do the reciprocal (do 1 over)

$\frac{1}{25}$

(1)

(b) Write $\frac{2^5 \times 2^4}{2^3}$ in the form 2^n where n is an integer.

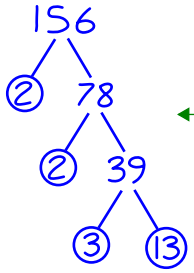
$\frac{2^9}{2^3}$ ← $a^x \times a^y = a^{x+y}$, so $2^5 \times 2^4 = 2^{5+4} = 2^9$

$a^x / a^y = a^{x-y}$, so $2^9/2^3 = 2^{9-3} = 2^6$ → 2^6

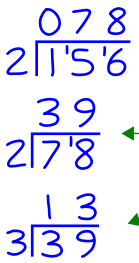
(2)

(Total for Question 2 is 4 marks)

3 (a) Write 156 as a product of its prime factors.



Doing a factor tree for 156 by splitting each number into factors and circling the primes



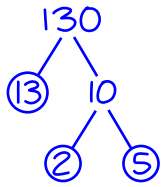
Some divisions to help do the factor tree

The circled primes are the prime factors. Writing these multiplied together

$2^2 \times 3 \times 13$

(2)

(b) Find the highest common factor (HCF) of 156 and 130



Doing a factor tree for 130 by splitting each number into factors and circling the primes

$2 \times 5 \times 13$

The circled primes are the prime factors. Writing these multiplied together. This expresses 130 as a product of its prime factors

2×13

The highest common factor is the lowest power of each prime in both of the products of prime factors multiplied together. Where there is none of a prime, this is the lowest power

26

(2)

(Total for Question 3 is 4 marks)

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4 The mean length of 5 sticks is 4.2 cm.

Nawal measured the length of one of the sticks as 7 cm.

(a) Work out the mean length of the other 4 sticks.

m t n

Mean = total/number, where total is the total length of all the sticks and number is the number of sticks. Writing this as a formula triangle

42
x 5
210

From the formula triangle, total = mean x number. So multiplying the mean of 4.2 cm by the 5 sticks works out that the total length of the 5 sticks is 21 cm. Ignoring the decimal then putting it back in after

21 - 7

Subtracting the 7 cm stick from the total of 21 cm works out that the total of the other 4 sticks is 14 cm

03.5
4 | 14.0

From the formula triangle, mean = total/number. So dividing the total length of the other 4 sticks by 4 works out the mean length of the other 4 sticks

3.5 cm

(3)

Nawal made a mistake.
The stick was not 7 cm long.
It was 17 cm long.

(b) How does this affect your answer to part (a)?

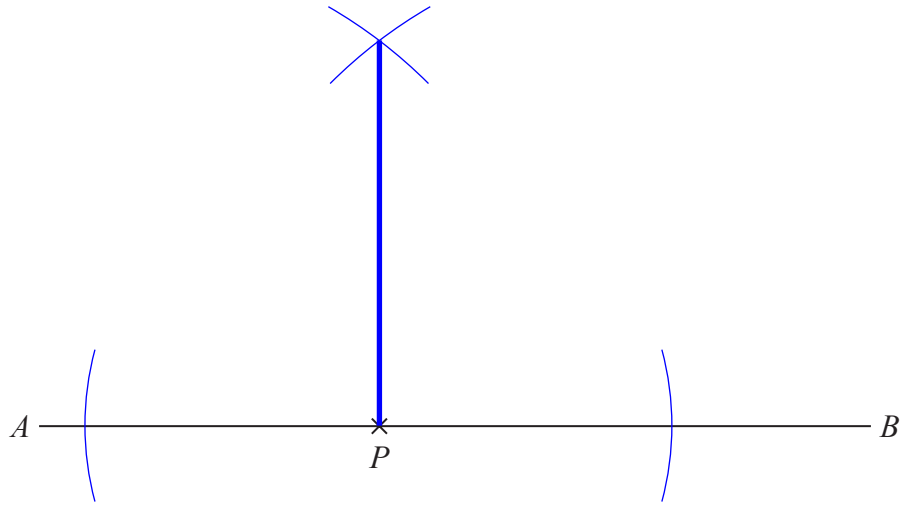
It will be less

As the total of the other 4 sticks will be less. Dividing this total by 4 to work out the mean will give a lower mean

(1)

(Total for Question 4 is 4 marks)

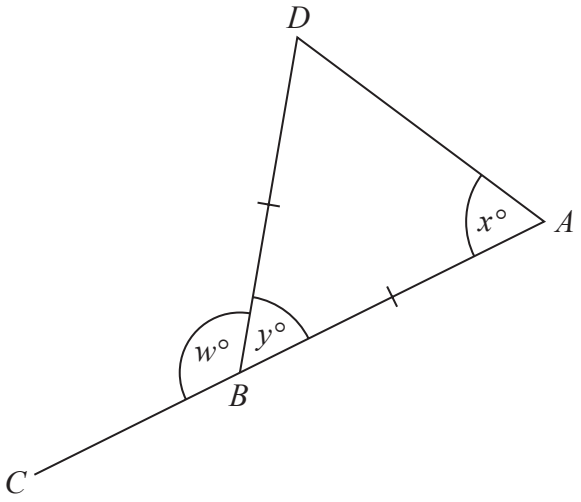
5 The point P lies on the line AB.
Use ruler and compasses to construct an angle of 90° at P.
You must show all your construction lines.



Scribing two arcs from point P using the same radius. Then scribing an arc from each of these arcs to form a cross. Drawing from P to this cross constructs an angle of 90° at P. This is basically doing an angle bisector of angle APB

(Total for Question 5 is 2 marks)

6 The diagram shows an isosceles triangle ABD and the straight line ABC.



$BA = BD$

$x : y = 2 : 1$

Work out the value of w.

y+2y+2y ← From the ratio, x is double y, so x = 2y. Angle BDA is also x as the base angles of an isosceles triangle are equal. Adding all the angles together in the triangle ABD and substituting x for 2y

5y=180 ← Simplifying the expression of the total of the angles in triangle ABD by collecting the like terms. Setting this equal to 180 as there are 180° in a triangle

5 ⟌ 180 = 036 ← Dividing both sides by 5 finds that y = 36

180 − 36 = 144 ← Angles around a point on a straight line add up to 180°. So subtracting angle y from 180 leaves angle w

$w =$ 144

(Total for Question 6 is 4 marks)

7 Mano has three shelves of books.

There are x books on shelf **A**.
There are $(3x + 1)$ books on shelf **B**.
There are $(2x - 5)$ books on shelf **C**.

There is a total of 44 books on the three shelves.

All the books have the same mass.

The books on shelf **B** have a total mass of 7500 g.

Work out the total mass of the books on shelf **A**.

$6x - 4 = 44$ ← Adding the expressions of the number of books on each shelf gives x + 3x + 1 + 2x - 5, which simplifies to 6x - 4, which must be equal to the 44 books as this is the total of the books on the three shelves

$6x = 48$ ← Adding 4 to both sides eliminates the -4 on the left and gets the x term on its own

$x = 8$ ← Dividing both sides by 6 eliminates the 6 on the left and gets x on its own

3×8 ← Multiplying the value of x by 3 works out that 3x is 24

$24 + 1$ ← Adding 1 works out that the value of 3x + 1 is 25, so there are 25 books on shelf B

$25\overline{)7500} = 300$ ← Dividing the mass of the books on shelf B by the the 25 books works out that each book has a mass of 300 g

$300 \times 8 = 2400$ ← There are 8 books on shelf A as this is the value of x. Multiplying the mass of each book by the 8 books works out that the total mass of the books on shelf A is 2400 g

2400 g

(Total for Question 7 is 5 marks)

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8 The normal price of a mattress is reduced by 40% in a sale.
The price of the mattress in the sale is £660

Work out the normal price of the mattress.

100 − 40 ← Subtracting the 40% from the original 100% works out that the price was reduced to 60%

$60\overline{)660}$ = 11 ← Dividing the £660 by 60 works out that 1% of the normal price is £11

11 × 100 ← Multiplying the value of 1% by 100 works out the full 100% of the normal price

Adding two zeros on the end multiplies it by 100

£ 1100

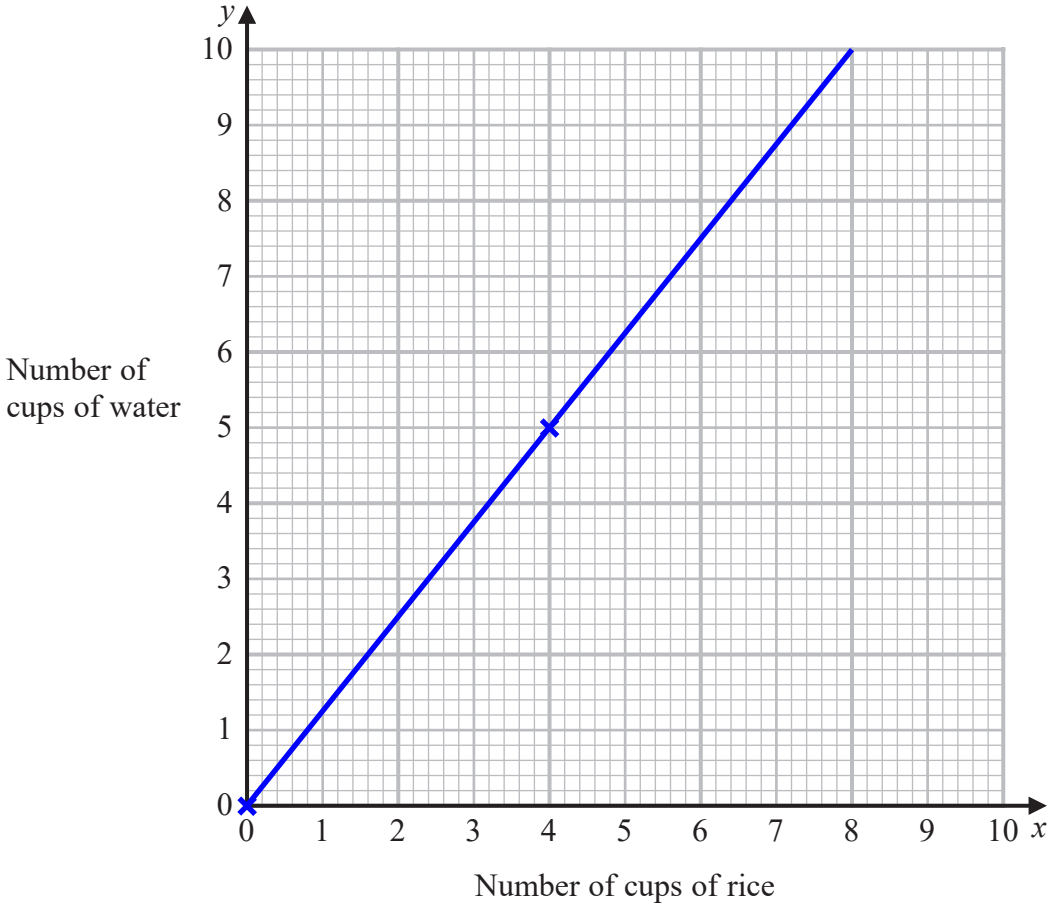
(Total for Question 8 is 2 marks)

9 To cook rice

the number of cups of rice (x) : the number of cups of water (y) = 4 : 5

(a) Use this information to draw a graph to show the relationship between the number of cups of rice and the number of cups of water needed to cook rice.

When there are 0 cups of rice, 0 cups of water will be needed. So plotting the point (0 , 0). When there are 4 cups of rice, 5 cups of water will be needed. So plotting the point (4 , 5). Drawing a straight line through both of these points



(2)

(b) (i) Find the gradient of the line drawn in part (a).

Gradient = (change in y)/(change in x). y changes from 0 to 5 so the change in y is 5. x changes from 0 to 4 so the change in x is 4

$\frac{5}{4}$

(1)

(ii) Explain what this gradient represents.

The number of cups of water per cup of rice

To work out the gradient, the cups of water was divided by the cups of rice. Per means to divide

(1)

(Total for Question 9 is 4 marks)

10 The circumference of a circle is 10 m.

Work out the area of the circle.
Give your answer in terms of π.

$2\pi r = 10$ ← 2πr = circumference, where r is the radius

$\pi r = 5$ ← Dividing both sides by 2

$r = \frac{5}{\pi}$ ← Dividing both sides by π finds the radius

$\pi \times \left(\frac{5}{\pi}\right)^2$ ← Area of circle = πr^2

$\pi \times \frac{25}{\pi^2}$ ← To square a fraction: square the numerator and square the denominator

Multiplying by π cancels out π on the denominator. $\pi^2 \div \pi = \pi$

$\frac{25}{\pi}$

..... m^2

(Total for Question 10 is 3 marks)

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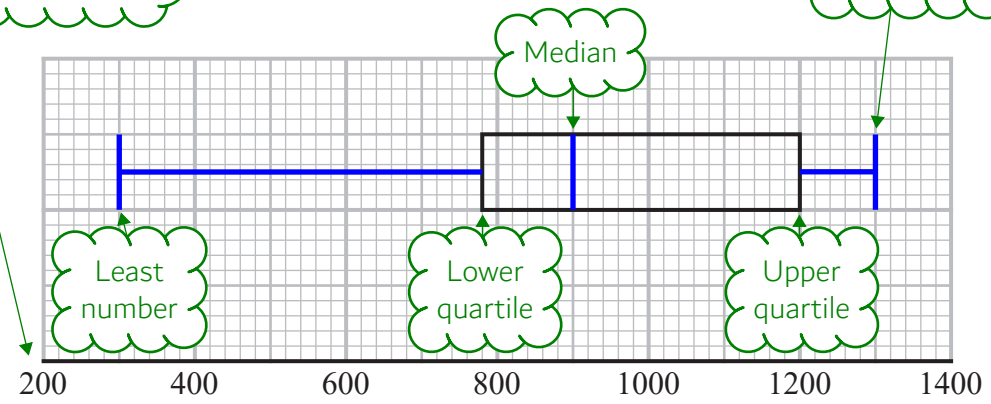
11 Alice recorded the number of cars going into a village on each of 80 days.

The incomplete table and the incomplete box plot give information about her results.

	Number of cars
Least number	300
Lower quartile	780
Median	900
Upper quartile	1200
Range	1000

The scale goes up 200 over 10 small boxes. 200 ÷ 10 = 20, so each small box is worth 20

The greatest number is found by adding the range to the least number



(a) (i) Use the information in the table to complete the box plot.

(ii) Use the information in the box plot to complete the table.

(3)

On some of these 80 days Alice saw fewer than 1200 cars going into the village.

(b) Work out an estimate for the number of days Alice saw fewer than 1200 cars going into the village.

$$4\overline{)80} = 20$$

$$20 \times 3 = 60$$

About 3/4 of the data is fewer than 1200 cars as 1200 is the upper quartile. Dividing the 80 days by 4 then multiplying the result by 3 works out 3/4 of the days

60

(2)

(Total for Question 11 is 5 marks)

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12 The straight line **L** has equation $2y = 3x - 7$

Find an equation of the straight line perpendicular to **L** that passes through (6, –5)

$y = \frac{3}{2}x - \frac{7}{2}$ ← Rearranging the equation of L into the form y = mx + c (where m is the gradient and c is the y-intercept) by dividing both sides by 2. The gradient of line L is 3/2

$y = -\frac{2}{3}x + c$ ← The gradient of the perpendicular line is the negative reciprocal of 3/2, which is -2/3

$c = -5 + \frac{2}{3}(6)$ ← Rearranging to find c by adding 2/3 x to both sides and substituting 6 for x and -5 for y from the coordinates of (6 , -5)

$= -1$ ← 2/3 of 6 is 4. Then -5 + 4 = -1

$y = -\frac{2}{3}x - 1$

(Total for Question 12 is 3 marks)

13 Solid **A** and solid **B** are similar.

The ratio of the height of solid **A** to the height of solid **B** is 2 : 5

The volume of solid **A** is 12 cm^3

Work out the volume of solid **B**.

$2^3 = 8$
$5^3 = 125$ ← Cubing both sides of the ratio works out that the ratio of the volume of solid A to the volume of solid B is 8 : 125

$\frac{12}{8} = \frac{6}{4} = \frac{3}{2}$ ← Dividing the volume of solid A by 8 works out the value of 1 part of the volume ratio. Simplifying this fraction

$\frac{3}{2} \times 125$ ← Multiplying the value of 1 part of the volume ratio by 125 works out the value of the 125 parts which represent the volume of solid B

$125 \times 3 = 375$ ← Multiplying the numerator by 125

375 cannot be divided by 2 to give an integer so it can be left as a fraction → $\frac{375}{2}$ cm^3

(Total for Question 13 is 3 marks)

14 Work out the value of $27^{\frac{2}{3}} + \left(\frac{1}{2}\right)^{-3}$

9+8 ↔ The denominator of the 2/3 power means to cube root. The cube root of 27 is 3. The numerator of the 2/3 power means to square. 3 squared is 9. The power of 3 means to cube. $(1/2)^3 = 1/8$. The negative power means to do the reciprocal (which can mean to flip the fraction). The reciprocal of 1/8 is 8

17

(Total for Question 14 is 3 marks)

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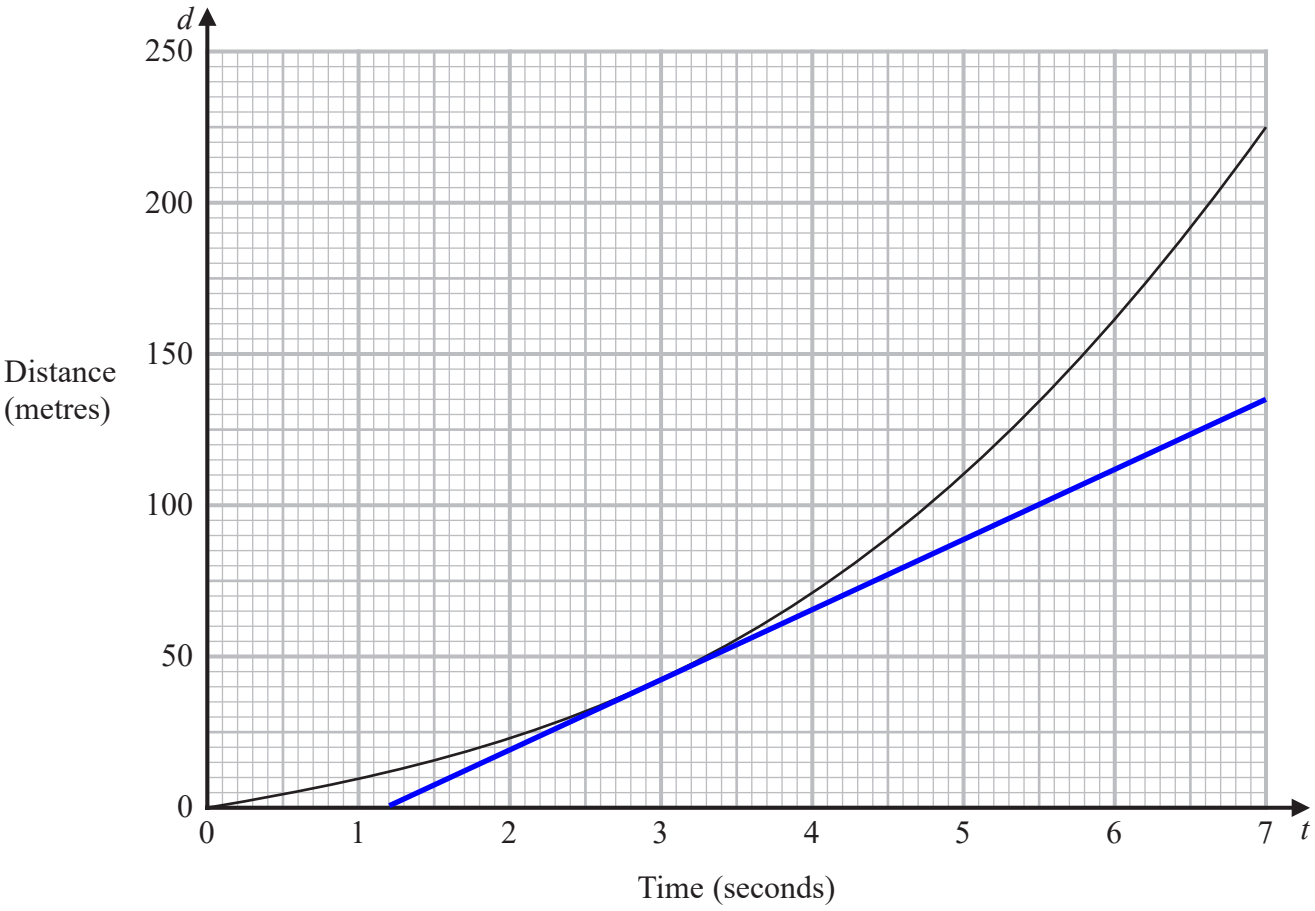
15 An object falls from rest.

Here is the distance-time graph for the distance (d metres) fallen by the object t seconds after it starts to fall.



Work out an estimate for the gradient of the graph at $t = 3$
You must show how you get your answer.

135−0 / 7−1.2

Drawing a tangent to the curve at the point where t = 3. Gradient = (change in y)/(change in x). Using the two end points of the tangent as these are on grid lines. y changes from 0 to 135 so the change in y is 135 - 0. x changes from 1.2 to 7 so the change in x is 7 - 1.2. The vertical scale goes up 50 over 10 small boxes. 50 ÷ 10 = 5 so each small box is worth 5. The horizontal scale goes up 1 over 10 small boxes. 1 ÷ 10 = 0.1 so each small box is worth 0.1

135 / 5.8

135 - 0 = 135 and 7 - 1.2 = 5.8

Getting rid of the decimals in the fraction by multiplying both the numerator and denominator by 10

1350 / 58

(Total for Question 15 is 3 marks)

16 At the start of year n the population of a species is P_n

At the start of the following year the population of the species is given by

$$P_{n+1} = kP_n \quad \text{where } k \text{ is a positive constant.}$$

The population of the species at the start of year 1 is 8 million.
The population of the species at the start of year 2 is 6 million.

(a) Work out the population of the species at the start of year 3

$\frac{6}{8} \times 6$ ← k = P_2/P_1 = 6/8. P_3 = 6/8 x P_2. The millions can be ignored as the million is in the answer

$\frac{36}{8}$ million

(3)

At the start of year 5 the value of k is increased by 0.3 to a new constant value.

Louise thinks that from the start of year 5 the population of the species would increase year on year.

(b) Is Louise correct?
You must give a reason for your answer.

6/8 = 3/4 = 0.75

0.75 + 0.3 = 1.05

The value of k will be more than 1. Multiplying by a value more than 1 will increase it

Yes

(1)

(Total for Question 16 is 4 marks)

17 (a) Factorise $6x^2 - 5x - 4$

1, 24
2, 12
3, 8

The quadratic is in the form $ax^2 + bx + c$. Multiplying a by c gives -24. Looking for two numbers which multiply to this and add to b, which is -5. Listing out the factor pairs of 24 until they add to -5 when one of the pair is negative

$6x^2 - 8x + 3x - 4$

-8 and 3 multiply to -24 and add to -5. Splitting the middle x term into these numbers of x

$2x(3x - 4) + 1(3x - 4)$

Factorising the left two terms and the right two terms separately. Bringing 1 out as a factor as there is no other common factor for the right two terms

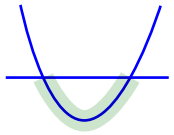
Bringing into the factorised form → $(2x + 1)(3x - 4)$

(2)

(b) Hence, or otherwise, solve $6x^2 - 5x - 4 < 0$

$2x + 1 = 0$
$x = -\frac{1}{2}$
$3x - 4 = 0$
$x = \frac{4}{3}$

Solving when the quadratic is equal to 0. One of the two brackets must equal to 0. Rearranging to give the solutions of x



Sketching the quadratic. It must be u-shaped as it is positive x^2. It is less than 0 for the highlighted region on the graph. The point on the left where it crosses the x-axis must be x = -1/2 and the point on the right where it crosses the x-axis must be x = 4/3

As the quadratic cannot be equal to 0, x cannot be equal to the solutions of the equation. This inequality describes the shaded region in the x-direction → $-\frac{1}{2} < x < \frac{4}{3}$

(2)

(Total for Question 17 is 4 marks)

18 Spinner **A** and spinner **B** are each spun once.

The probability that spinner **A** lands on red is $\frac{1}{4}$

The probability that both spinner **A** and spinner **B** land on red is $\frac{1}{24}$

Work out the probability that one spinner lands on red and the other spinner does **not** land on red.

$\frac{1}{4} \times B = \frac{1}{24}$ ← Let B the probability that spinner B lands on red. AND means to multiply the probabilities. So multiplying the probability that spinner A lands on red and the probability that spinner B lands on red must give the probability that both land on red

$B = \frac{4}{24} = \frac{1}{6}$ ← Multiplying both sides by 4 eliminates the 1/4 on the left and finds that the probability that spinner B lands on red is 4/24. Simplifying this by dividing both the numerator and denominator by 4 gives 1/6

$\frac{1}{4} \times \frac{5}{6} + \frac{3}{4} \times \frac{1}{6}$ ← Spinner A is red AND spinner B is not red OR spinner A is not red AND spinner B is red. AND means to multiply the probabilities. OR means to add the probabilities. The probability that spinner A lands on red is 1/4 so the probability that it does not land on red must be 3/4 as the probabilities must add to 1. The probability that spinner B lands on red is 1/6 so the probability that it does not land on red must be 5/6 as the probabilities must add to 1

$\frac{5}{24} + \frac{3}{24}$ ← Doing the order of operations (BIDMAS) so multiplying the fractions first. To multiply fractions: multiply the numerators and multiply the denominators

The denominators of both fractions are the same so the numerators can be added →

$\frac{8}{24}$

(Total for Question 18 is 4 marks)

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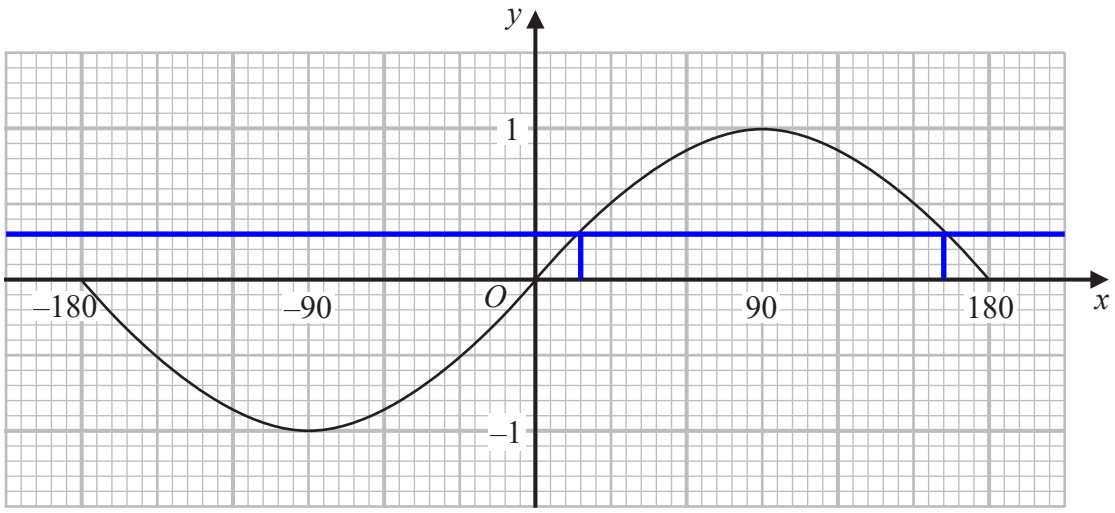
19 Here is the graph of $y = \sin x°$ for $-180 \leqslant x \leqslant 180$



(a) Use the graph to find estimates for the solutions of

$$\sin x° = 0.3 \quad \text{for } -180 \leqslant x \leqslant 180$$

Drawing a horizontal line across where y = 0.3 then reading down where the graph meets this line. The horizontal scale goes up 30 over 5 small boxes. 30 ÷ 5 = 6, so each small box is worth 6

18, 162

(2)

(b) Write down a value of x such that

$$\sin(x + 20)° = 0 \quad \text{for } -180 \leqslant x \leqslant 180$$

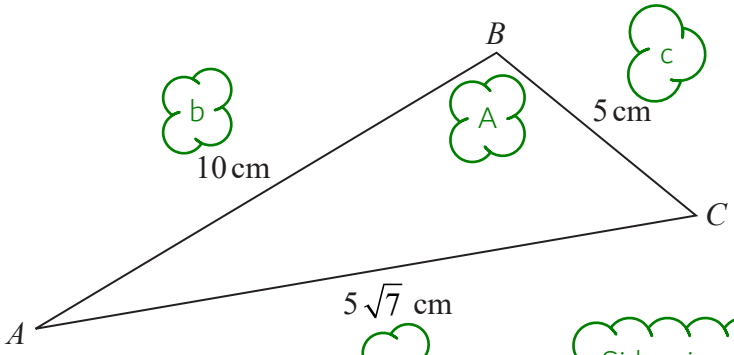
From the graph, sin0 = 0. So x + 20 = 0 and rearranging this finds that x = -20. This is within the range of x

$x =$ -20

(1)

(Total for Question 19 is 3 marks)

20 Here is triangle *ABC*.



Side a is opposite angle A

Find the size of angle *ABC*.
You must show all your working.

$a^2 = b^2 + c^2 - 2bc\cos A$ ← The sine rule cannot be used as there are not two opposite pairs of sides and angles. So writing down the cosine rule

$-2bc\cos A = a^2 - b^2 - c^2$ ← Rearranging to make cosA the subject. First subtracting b^2 and c^2 from both sides

$\cos A = \frac{a^2 - b^2 - c^2}{-2bc}$ ← Dividing both sides by -2bc makes cosA the subject

$\frac{(5\sqrt{7})^2 - 10^2 - 5^2}{-2 \times 10 \times 5}$ ← Substituting in the values into the right side of the equation

$25 \times 7 = 175$ ← $(5\sqrt{7})^2 = 5^2 \times (\sqrt{7})^2 = 25 \times 7$

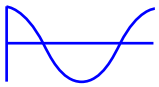
$-125 = 50$ ← $10^2 = 100$ and $5^2 = 25$. Subtracting both of these combined

$\frac{50}{-100} = -\frac{1}{2}$ ← -2 x 10 x 5 = -100. Simplifying the fraction

120 °

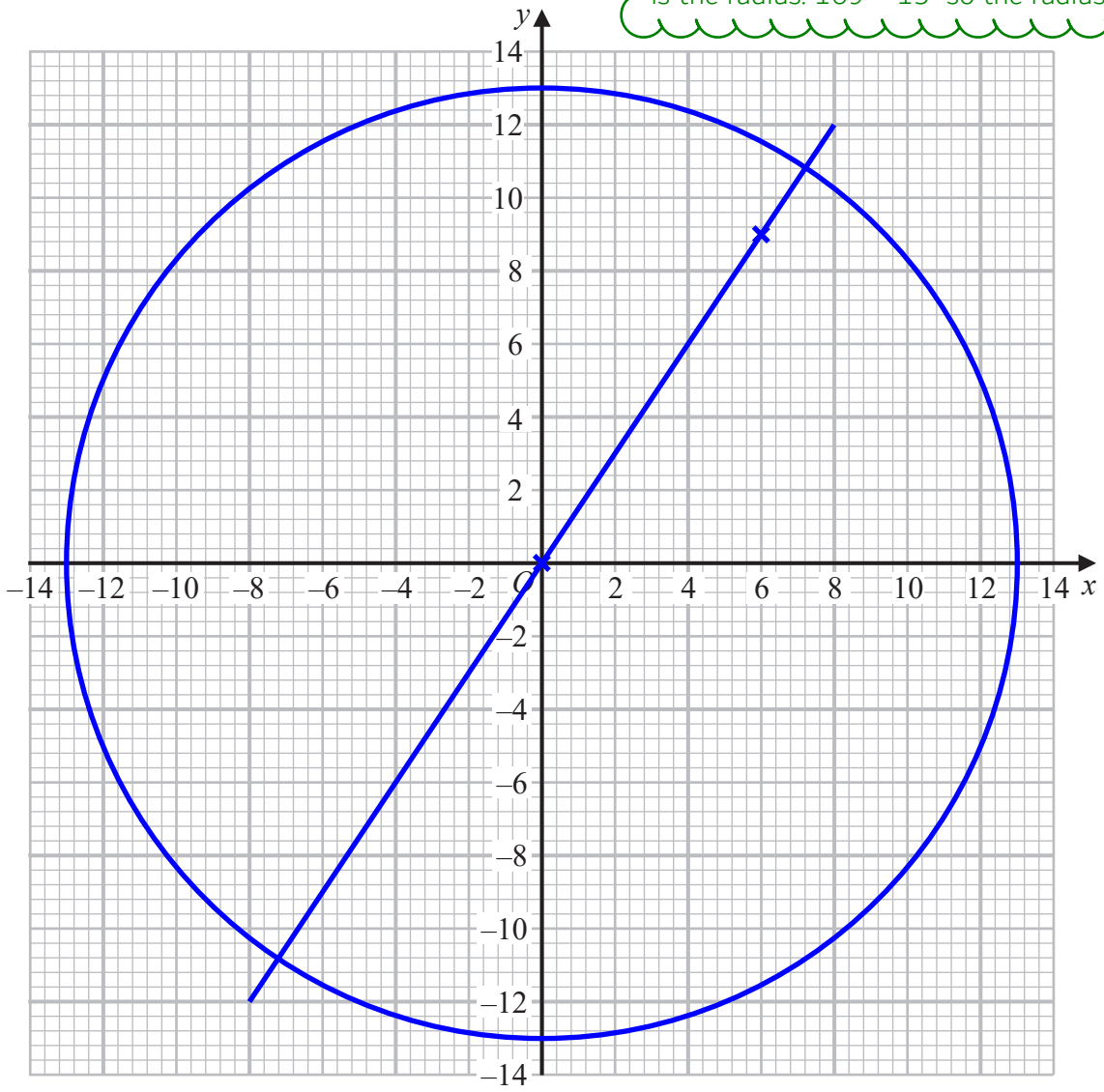
(Total for Question 20 is 4 marks)

0 30 45 60 90
4 3 2 1 0 ← Listing out the angles of 0, 30, 45, 60, 90. Writing 4, 3, 2, 1, 0 under these. Square rooting these and putting them over 2 finds that cos60 = 1/2

 ← Sketching a cos curve to work out where on the graph it would be equal to -1/2. If cos60 is 1/2, cos120 must be -1/2 as 120 is 60 before 180

21 (a) On the grid, draw the graph of $x^2 + y^2 = 169$

This is the general equation of a circle with its centre at the origin: $x^2 + y^2 = r^2$, where r is the radius. $169 = 13^2$ so the radius is 13



(2)

(b) Use your graph to find estimates for the solutions of the simultaneous equations

$$x^2 + y^2 = 169$$
$$2y = 3x$$

$y = \frac{3}{2}x$ ← Rearranging the second equation to make y the subject by dividing both sides by 2

$x = 7.2$, $y = 10.8$ and $x = -7.2$, $y = -10.8$

(3)

(Total for Question 21 is 5 marks)

Drawing the graph of $y = 3/2\ x$ then finding the coordinates where the two graphs cross finds estimates for the solutions of the simultaneous equations. When x = 0, y = 3/2 x 0 = 0, so plotting the point (0 , 0). When x = 6, y = 3/2 x 6 = 9, so plotting the point (6 , 9). It is a straight line so getting a ruler and drawing a line through these two points completes the graph. The scales go up 2 over 5 small boxes. 2/5 = 0.4, so each small box is worth 0.4

22 The 2nd term of a geometric sequence is $3 + 2\sqrt{2}$
The 3rd term of the sequence is $13 + 9\sqrt{2}$

Find the value of the common ratio of the sequence.
Give your answer in the form $a + \sqrt{b}$ where a and b are integers.
You must show all your working.

$\frac{(13+9\sqrt{2})(3-2\sqrt{2})}{(3+2\sqrt{2})(3-2\sqrt{2})}$

The common ratio is what each term is multiplied by to get to the next term in the sequence. Let r be the common ratio. (2nd term) x r = (3rd term), so r = (3rd term)/(2nd term). Writing this then rationalising the denominator by multiplying both the numerator and denominator by 3 - $2\sqrt{2}$ (which is the same as the denominator but the plus has become a minus)

$\frac{39-26\sqrt{2}+27\sqrt{2}-36}{9-6\sqrt{2}+6\sqrt{2}-8}$

Expanding the brackets

$\frac{3+\sqrt{2}}{1}$

Collecting like terms

The denominator was 1 and dividing by 1 has no effect so it can be ignored

$3+\sqrt{2}$

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS

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