Please check the examination details below before entering your candidate information

Candidate surname	Other names

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

Centre Number	Candidate Number

Thursday 6 June 2019

Morning (Time: 1 hour 30 minutes) | Paper Reference **1MA1/2H**

Mathematics

Paper 2 (Calculator)
Higher Tier

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

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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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 (a) Solve $14n > 11n + 6$

$3n > 6$

Subtract $11n$ from both sides to get all the n terms on the same side of the equation.

Divide both sides by 3 to get n on its own.

$n > 2$

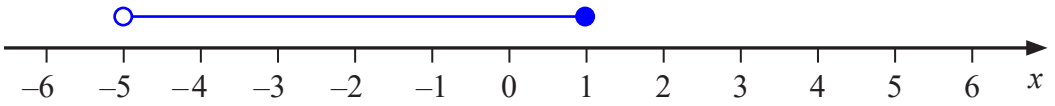
(2)

(b) On the number line below, show the set of values of x for which $-2 < x + 3 \leqslant 4$

$-5 < x \leqslant 1$

Closed circle means that the value is included in the set. Open circle means the value isn't included. A line is drawn over the values included between the circles.

Subtract 3 from all sides of the inequality to get x on its own.



(3)

(Total for Question 1 is 5 marks)

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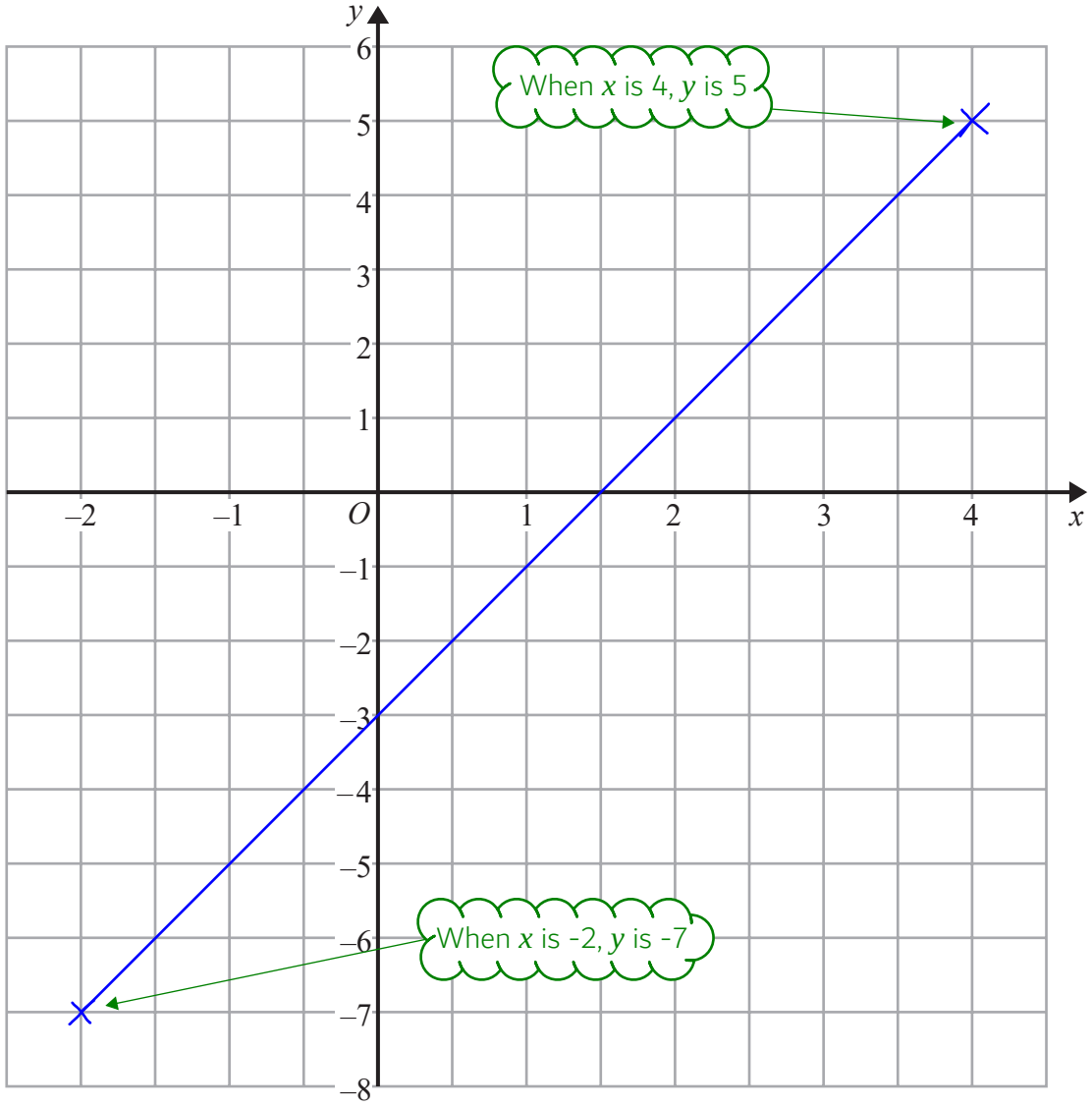
2 On the grid below, draw the graph of $y = 2x - 3$ for values of x from -2 to 4

$y = 2 \times (-2) - 3 = -7$

$y = 2 \times 4 - 3 = 5$

Substituting in the highest and lowest values of x (any two values will do but this technique can possibly get a more accurate line).

It is a linear equation (no powers of x or y) so the line will be straight. Therefore only two points are required to draw the line.



(Total for Question 2 is 3 marks)

3 Hannah is planning a day trip for 195 students.

She asks a sample of 30 students where they want to go.
Each student chooses one place.

The table shows information about her results.

Place	Number of students
Theme Park	10
Theatre	5
Sports Centre	8
Seaside	7

(i) Work out how many of the 195 students you think will want to go to the Theme Park.

$\frac{10}{30} \times 195$

10 out of the 30 in the sample chose the Theme Park therefore we can estimate that there will be this fraction of the total students.

65

(2)

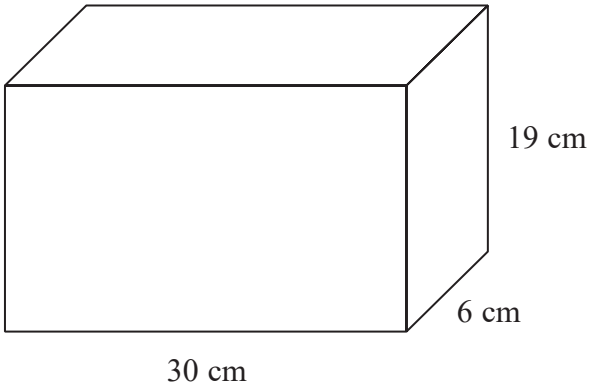
(ii) State any assumption you made **and** explain how this may affect your answer.

The sample was representative of the whole group. The answer would be different if this wasn't true.

(1)

(Total for Question 3 is 3 marks)

4 A container is in the shape of a cuboid.



The container is $\frac{2}{3}$ full of water.

A cup holds 275 m*l* of water.

What is the greatest number of cups that can be completely filled with water from the container?

Multiplying the volume of the container by 2/3 works out the volume of the water.

This works out the volume of the container in cubic centimetres.

$$\frac{\frac{2}{3} \times 30 \times 6 \times 19}{275} = 8.29\dot{0}$$

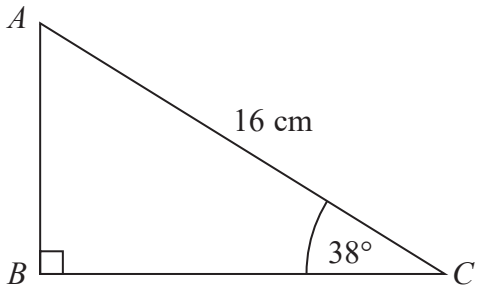
Dividing by 275 works out how many lots of 275ml go into the volume of the water. 1ml is 1cm^3.

We are looking for full cups so the answer is rounded down.

8

(Total for Question 4 is 4 marks)

5 *ABC* is a right-angled triangle.



Calculate the length of *AB*.
Give your answer correct to 2 decimal places.

SOH CAH TOA

Sin 38 X 16

There is a right angled triangle with a problem involving sides and angles so SOH CAH TOA can be used. We have the hypotenuse and are finding the opposite so the sin formula can be used. From the formula triangle: opposite = sin of the angle x hypotenuse

9.85 ..... cm

(Total for Question 5 is 2 marks)

6 Sally used her calculator to work out the value of a number *y*.

The answer on her calculator display began

8.3

Complete the error interval for *y*.

8.3 $\leqslant y <$ 8.4

(Total for Question 6 is 2 marks)

7 £360 is shared between Abby, Ben, Chloe and Denesh.

The ratio of the amount Abby gets to the amount Ben gets is 2 : 7

Chloe and Denesh each get 1.5 times the amount Abby gets.

Work out the amount of money that Ben gets.

$2 \times 1.5 = 3$ ← If Abby gets 2 parts, Chloe and Denesh both get 1.5 times this so they both get 3 parts.

2 : 7 : 3 : 3 ← This is the ratio of what they each get. Abby : Ben : Chloe : Denesh

$\frac{360}{2+7+3+3} \times 7$ Dividing by the total number of parts calculates the value of 1 part. Multiplying by 7 calculates the value of 7 parts, which Ben has.

£ 168

(Total for Question 7 is 4 marks)

8 (a) Write 0.00562 in standard form.

Multiply by 10 3 times to get a decimal between 1 and 10 so multiplying by 10^{-3} keeps the value the same.

5.62×10^{-3}

(1)

(b) Write 1.452×10^3 as an ordinary number.

Multiply 1.452 by 10 3 times.

1452

(1)

(Total for Question 8 is 2 marks)

9 The circumference of circle **B** is 90% of the circumference of circle **A**.

(a) Find the ratio of the area of circle **A** to the area of circle **B**.

$2\pi r = C$

$r = \frac{C}{2\pi}$

r is the radius and c is the circumference. This verifies that if the circumference is 90%, the radius will be 90% as 2π is constant.

$r_A : r_B = 1 : 0.9$

Making a ratio of the radius of A to B.

The scale factor of 0.9 makes it 90%.

Both sides of the ratio are squared as the radius is squared when finding the area of a circle.

1 : 0.81

(2)

Square **E** has sides of length e cm.
Square **F** has sides of length f cm.

The area of square **E** is 44% greater than the area of square **F**.

(b) Work out the ratio $e : f$

$A_E : A_F = 1.44 : 1$

Making a ratio of the area of E to F.

The scale factor of 1.44 makes it 44% greater.

Both sides of the ratio are square rooted as the area is square rooted when finding the side length of a square.

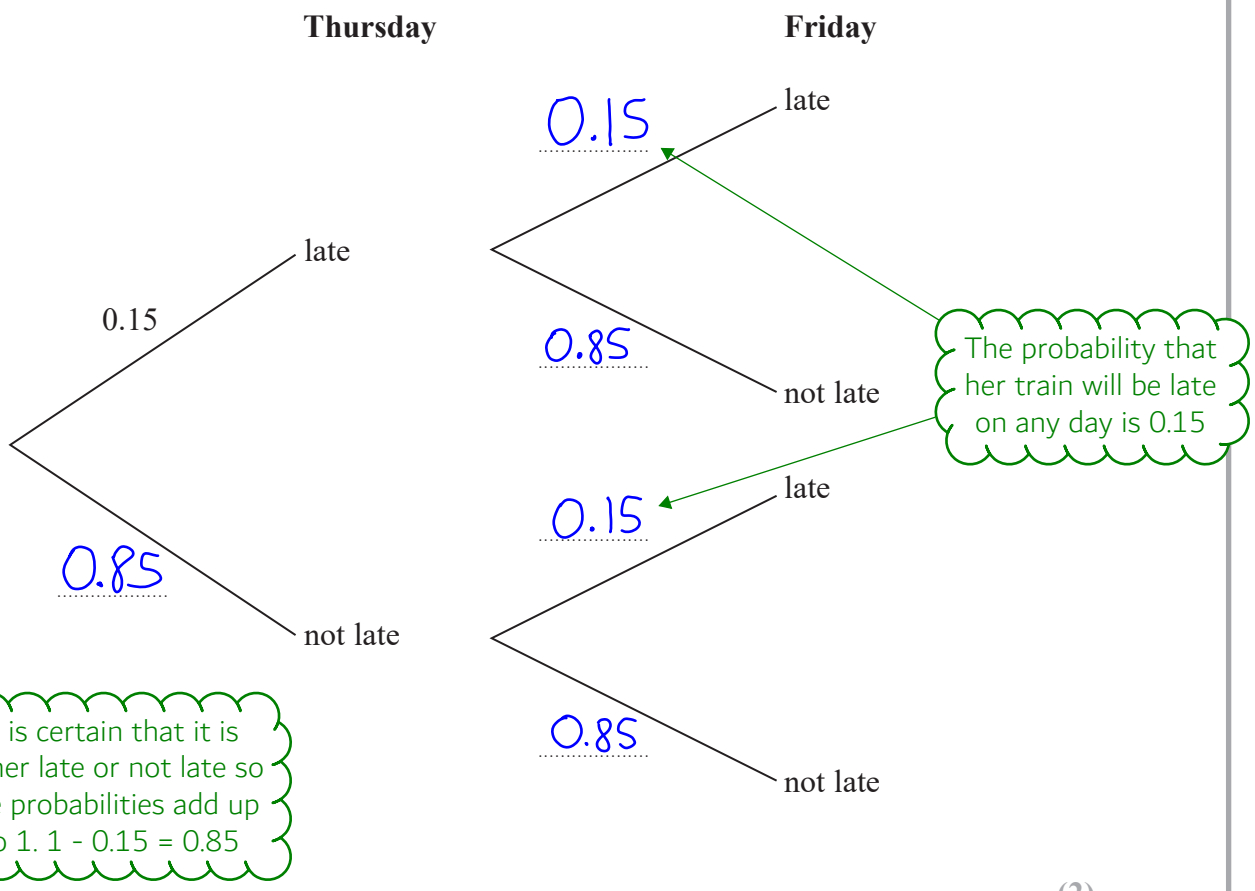
1.2 : 1

(2)

(Total for Question 9 is 4 marks)

10 Mary travels to work by train every day.
The probability that her train will be late on any day is 0.15

(a) Complete the probability tree diagram for Thursday and Friday.



(2)

(b) Work out the probability that her train will be late on at least one of these two days.

$1 - 0.85 \times 0.85$

Subtracting the probability of the train not being late on both days from 1 leaves the probability it is late on at least one of the days.

0.2775

(3)

(Total for Question 10 is 5 marks)

11 The grouped frequency table gives information about the times, in minutes, that 80 office workers take to get to work.

Time (t minutes)	Frequency
$0 < t \leqslant 20$	5
$20 < t \leqslant 40$	30
$40 < t \leqslant 60$	20
$60 < t \leqslant 80$	15
$80 < t \leqslant 100$	8
$100 < t \leqslant 120$	2

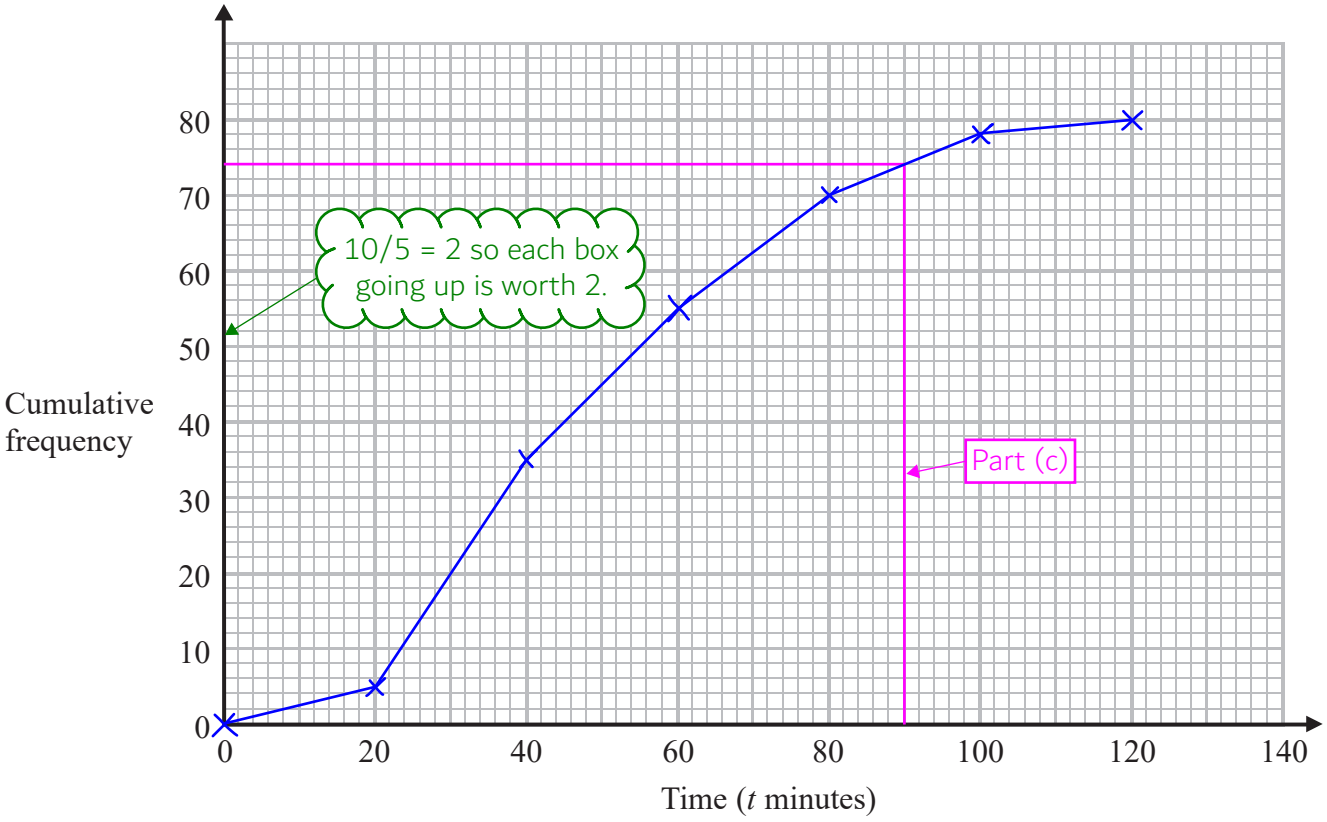
(a) Complete the cumulative frequency table.

Time (t minutes)	Cumulative frequency
$0 < t \leqslant 20$	5
$0 < t \leqslant 40$	35 ← 5 + 30
$0 < t \leqslant 60$	55 ← 35 + 20
$0 < t \leqslant 80$	70 ← 55 + 15
$0 < t \leqslant 100$	78 ← 70 + 8
$0 < t \leqslant 120$	80 ← 78 + 2

(1)

Add up and combine the frequencies as you go down the column.

(b) On the grid, draw the cumulative frequency graph for this information.



(2)

(c) Use your graph to find an estimate for the percentage of these office workers who take more than 90 minutes to get to work.

$\frac{80-74}{80} \times 100$

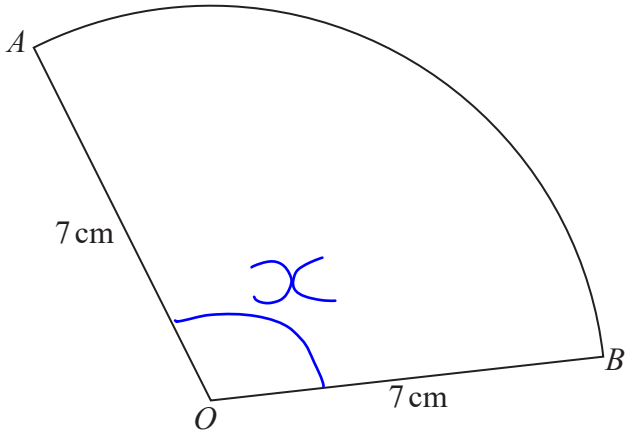
74 is read off the graph. 80 - 74 calculates how many people were later than 90 minutes. Putting this into a fraction out of the 80 people and then multiplying by 100 converts it into a percentage.

7.5 %

(3)

(Total for Question 11 is 6 marks)

12 OAB is a sector of a circle with centre O and radius 7 cm.



The area of the sector is 40 cm^2

Calculate the perimeter of the sector.
Give your answer correct to 3 significant figures.

$\pi \times 7^2 \times \frac{x}{360} = 40$

πr^2 = area of circle. $x/360$ is the proportion of the circle which makes up the sector. The area of the sector is 40cm^2.

$x = \frac{40 \times 360}{\pi \times 7^2}$

Rearranged to find angle x.

$2 \times \pi \times 7 \times \frac{93.5...}{360} + 7 + 7$

Adding the two radii to the arc length gives the perimeter.

$2\pi r$ calculates the circumference of the whole circle.

This calculates the proportion of the circle which is the sector. The exact value of x is used for the calculation.

25.4 cm

(Total for Question 12 is 4 marks)

13 Show that $6 + \left[(x + 5) \div \frac{x^2 + 3x - 10}{x - 1} \right]$ simplifies to $\frac{ax - b}{cx - d}$ where a, b, c and d are integers.

$6 + \frac{(x+5)(x-1)}{(x+5)(x-2)}$

Multiply by the reciprocal (flip the fraction) to divide by a fraction. Factorise the new denominator.

$\frac{6(x-2)}{x-2} + \frac{x-1}{x-2}$

Cancel out the common factor of $x + 5$ from the numerator and denominator. Multiply 6 by $(x - 2)/(x - 2)$ to make a common denominator so it can be combined with the fraction.

$\frac{6x-12+x-1}{x-2}$

Expand out the bracket and combine the fractions.

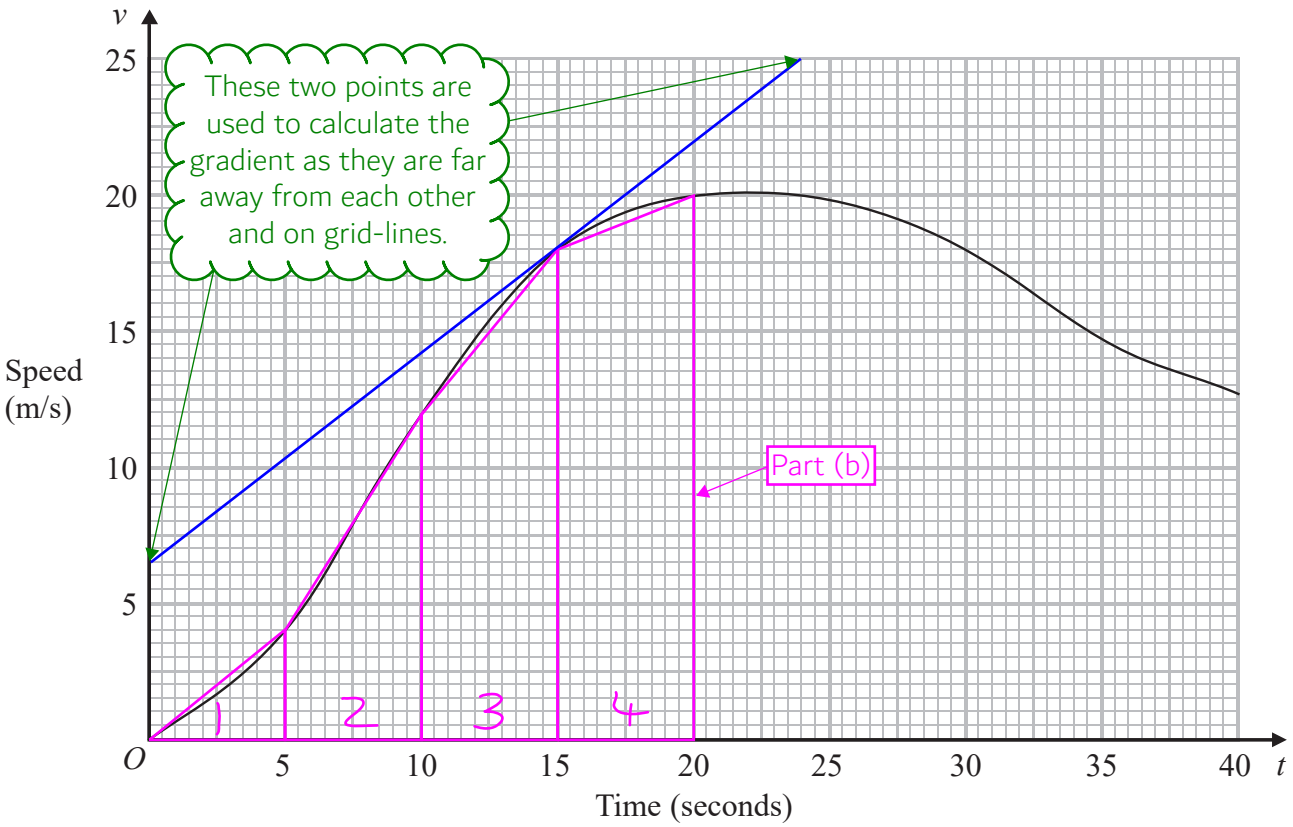
$\frac{7x-13}{x-2}$

Simplify the numerator.

(Total for Question 13 is 4 marks)

14 A car moves from rest.

The graph gives information about the speed, v metres per second, of the car t seconds after it starts to move.



(a) (i) Calculate an estimate of the gradient of the graph at $t = 15$

$\frac{25-6.5}{24-0}$

Change in y / Change in x

0.8

(3)

(ii) Describe what your answer to part (i) represents.

Acceleration

(1)

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(b) Work out an estimate for the distance the car travels in the first 20 seconds of its journey.
Use 4 strips of equal width.

$\frac{1}{2} \times 5 \times 4 + \frac{1}{2}(4+12) \times 5 + \frac{1}{2}(12+18) \times 5 + \frac{1}{2}(18+20) \times 5$

Strip 1: area of triangle = bh/2

Strip 2: area of trapezium = 1/2 x (a + b)h

Strip 3: area of trapezium = 1/2 x (a + b)h

Strip 4: area of trapezium = 1/2 x (a + b)h

220 m

(3)

(Total for Question 14 is 7 marks)

15 Make m the subject of the formula $f = \frac{3m + 4}{m - 1}$

$f(m-1) = 3m + 4$ ← Eliminate the denominator by multiplying both sides by m - 1

$fm - f = 3m + 4$ ← Expand out the brackets

$fm - 3m = 4 + f$ ← Bringing all the terms involving m to one side and everything else to the other.

$m(f-3) = 4 + f$ ← Bringing m out as a factor.

Dividing by the bracket to leave m on its own. → $m = \frac{4+f}{f-3}$

(Total for Question 15 is 3 marks)

16 The straight line **L** has the equation $3y = 4x + 7$
The point A has coordinates $(3, -5)$

Find an equation of the straight line that is perpendicular to **L** and passes through A.

$y = \frac{4}{3}x + \frac{7}{3}$ ← Rearranging the equation for line L into the form $y = mx + c$ where m is the gradient and c is the y-intercept.

$y = \frac{-3}{4}x + c$ ← Writing the equation of the perpendicular line in the form $y = mx + c$. The gradient (-3/4) is the negative reciprocal of 4/3 (the gradient of line L) as the lines are perpendicular.

$c = y + \frac{3}{4}x$ ← Rearranging the equation of the perpendicular line to find c.

$= -5 + \frac{3}{4} \times 3$ ← Substituting in the x and y coordinates of point A, which must satisfy the equation as it is on the perpendicular line.

$= -\frac{11}{4}$

$y = -\frac{3}{4}x - \frac{11}{4}$

(Total for Question 16 is 3 marks)

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17 There are some small cubes and some large cubes in a bag.
The cubes are red or the cubes are yellow.

The ratio of the number of small cubes to the number of large cubes is 4 : 7

The ratio of the number of red cubes to the number of yellow cubes is 3 : 5

(a) Explain why the least possible number of cubes in the bag is 88

There are 11 parts in the first ratio.

There are 8 parts in the second ratio.

The lowest common multiple of 8 and 11 is 88.

(1)

All the small cubes are yellow.

(b) Work out the least possible number of large yellow cubes in the bag.

32 : 56 (4 x 8 : 7 x 8)

33 : 55 (3 x 11 : 5 x 11)

Scale up the ratios so that they are both have 88 parts in total as this is the smallest number of cubes.

55 - 32

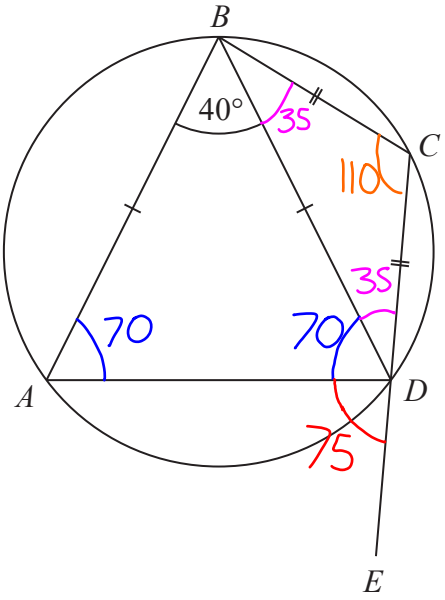
There are 55 yellow cubes. As there are 32 small cubes, there are also 32 small yellow cubes. 55 - 32 leaves us with the large yellow cubes.

23

(3)

(Total for Question 17 is 4 marks)

18 The points A, B, C and D lie on a circle.
CDE is a straight line.



$BA = BD$
$CB = CD$
Angle $ABD = 40°$

Work out the size of angle ADE.
You must give a reason for each stage of your working.

Triangle ABD is isosceles so the base angles are equal. $\frac{180-40}{2} = 70$

Opposite angles on a cyclic quadrilateral add up to 180°. $180 - 70 = 110$

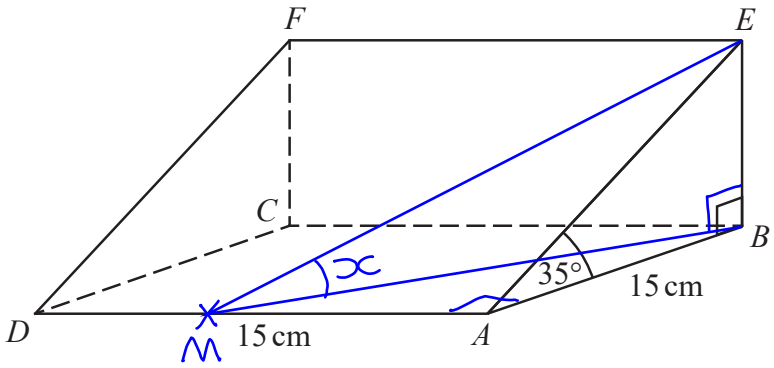
Triangle BCD is isosceles so the base angles are equal. $\frac{180-110}{2} = 35$

Angles on a straight line add up to 180°. $180-35-70$

$ADE = 75$

(Total for Question 18 is 5 marks)

19 The diagram shows a triangular prism.



The base, *ABCD*, of the prism is a square of side length 15 cm.
Angle *ABE* and angle *CBE* are right angles.
Angle *EAB* = 35°

M is the point on *DA* such that

$$DM : MA = 2 : 3$$

Calculate the size of the angle between *EM* and the base of the prism.
Give your answer correct to 1 decimal place.

SOH CAH TOA

$Opp = \tan\theta \times Adj$

Using trigonometry on triangle EAB to find length EB.

$EB = 15\tan 35$

$MA = \frac{15}{5} \times 3 = 9$

5 parts of the ratio is 15cm so 3 parts, which represents MA, is 9cm.

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

$MB = \sqrt{9^2 + 15^2} = 3\sqrt{34}$

Pythagoras' Theorem can be used on triangle MBA as it is right angled and two sides are now known and a third is to be found.

SOH CAH TOA

$\tan x = \frac{Opp}{Adj}$

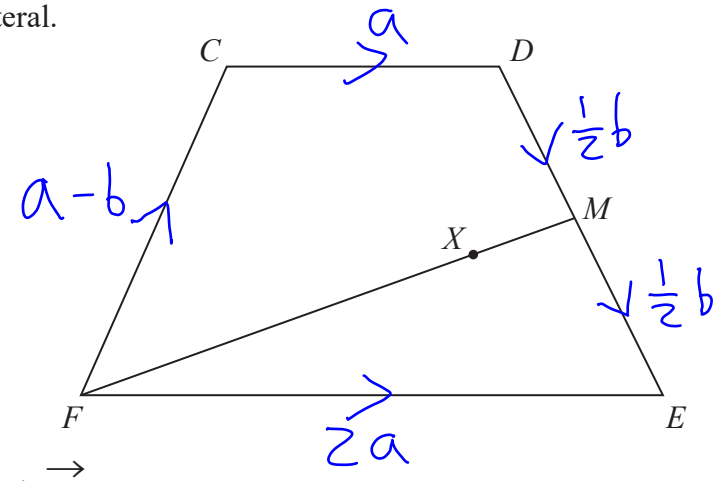
Using trigonometry on triangle MEB to find angle *x*.

$x = \tan^{-1}\left(\frac{15\tan 35}{3\sqrt{34}}\right)$

31.0 °

(Total for Question 19 is 4 marks)

20 *CDEF* is a quadrilateral.



$\overrightarrow{CD} = \mathbf{a}$, $\overrightarrow{DE} = \mathbf{b}$ and $\overrightarrow{FC} = \mathbf{a} - \mathbf{b}$.

(a) Express $\overrightarrow{FE}$ in terms of **a** and/or **b**.
Give your answer in its simplest form.

$a - b + a + b$

$\overrightarrow{FE} = \overrightarrow{FC} + \overrightarrow{CD} + \overrightarrow{DE}$

$2a$

(2)

M is the midpoint of *DE*.
X is the point on *FM* such that $FX : XM = n : 1$
CXE is a straight line.

(b) Work out the value of *n*.

$\overrightarrow{CE} = a + b$

$\overrightarrow{CE} = \overrightarrow{CD} + \overrightarrow{DE}$

$\overrightarrow{CX} = b - a + \frac{n}{n+1}\left(2a - \frac{1}{2}b\right)$

$= b - a + \frac{2n}{n+1}a - \frac{n}{2(n+1)}b$

$= \left(\frac{2n}{n+1} - 1\right)a + \left(1 - \frac{n}{2(n+1)}\right)b$

$\overrightarrow{CX} = \overrightarrow{CF} + \overrightarrow{FX}$
$\overrightarrow{CF} = -\overrightarrow{FC}$
$\overrightarrow{FX}$ is a fraction of $\overrightarrow{FM}$
$\overrightarrow{FM} = \overrightarrow{FE} + \overrightarrow{EM}$
$\overrightarrow{EM} = -\overrightarrow{ME}$
The fraction is n/(n + 1) and is found from the ratio.

Simplified into this form as it is on a straight line with CE so it must be a multiple of a + b

$\frac{2n}{n+1} - 1 = 1 - \frac{n}{2(n+1)}$

These have to be equal so that $\overrightarrow{CX}$ is a multiple of a + b

$4n - 2(n+1) = 2(n+1) - n$

$4n - 2n - 2 = 2n + 2 - n$

$n =$ 4

(4)

(Total for Question 20 is 6 marks)

TOTAL FOR PAPER IS 80 MARKS