

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)

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Tuesday 19 May 2020

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.
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.
- 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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.CG Maths.

Hints



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

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

- 1 The first five terms of an arithmetic sequence are

1 4 7 10 13

Write down an expression, in terms of n , for the n th term of this sequence.

It will be in the form $an + b$, where a is the amount it changes by between each term and b is the 0th term, the one which would be before the 1st term

(Total for Question 1 is 2 marks)

- 2 Show that

$$2\frac{1}{3} \times 3\frac{3}{4} = 8\frac{3}{4}$$

Convert the mixed numbers into improper fractions by multiplying the whole number by the denominator then adding the result to the numerator. The fractions can be multiplied by multiplying the numerators and denominators. The fraction should be an improper fraction, which can now be written as $8\frac{3}{4}$

(Total for Question 2 is 3 marks)

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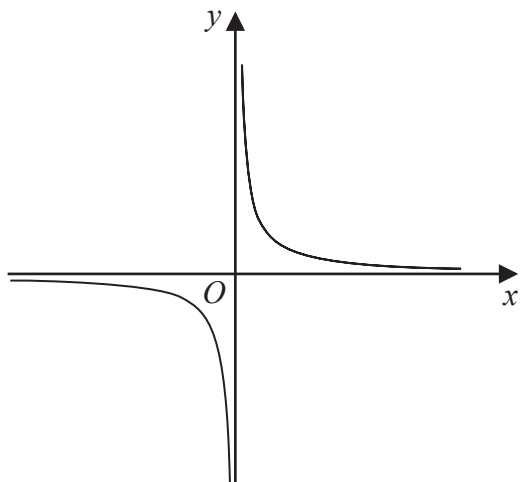
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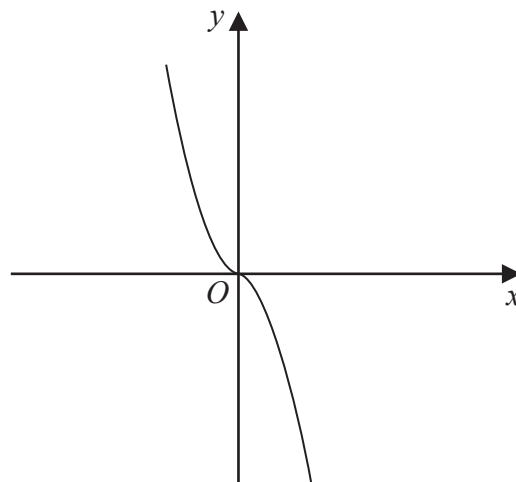
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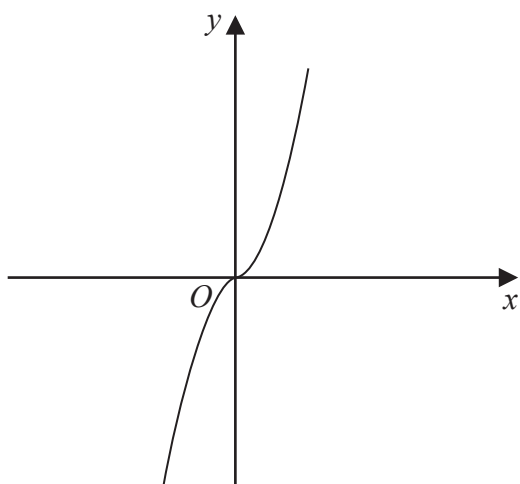
3 The diagram shows four graphs.



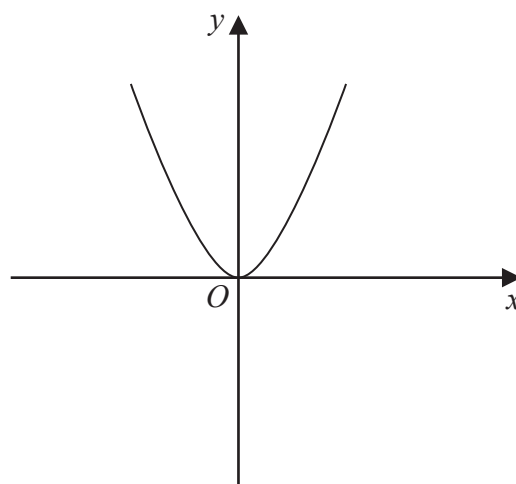
Graph A



Graph B



Graph C



Graph D

Each of the equations in the table is the equation of one of the graphs.

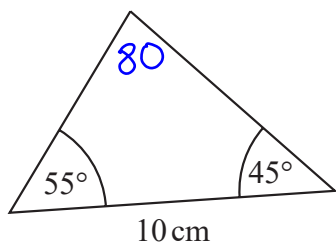
Complete the table.

| x | -2 | -1 | 0 | 1 | 2 | Equation | Letter of graph |
|-----|----|----|---|---|---|-------------------|-----------------|
| 5 | | | | | | $y = -x^3$ | |
| 5 | | | | | | $y = x^3$ | |
| 5 | | | | | | $y = x^2$ | |
| 5 | | | | | | $y = \frac{1}{x}$ | |

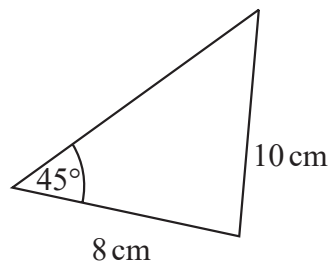
Doing a table of values for x values from -2 to 2 can work out which graph is which equation

(Total for Question 3 is 2 marks)

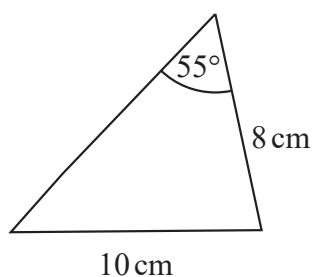
4 The diagram shows four triangles.



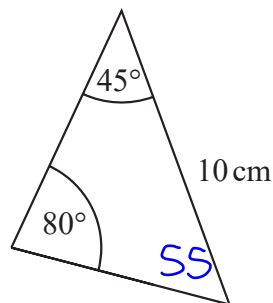
Triangle A



Triangle B



Triangle C



Triangle D

Two of these triangles are **congruent**.

All the sides and angles are the same

Write down the letters of these two triangles.

The 10 cm needs to be opposite the same angle

..... and

(Total for Question 4 is 1 mark)

5 Sean pays £10 for 24 chocolate bars.

He sells all 24 chocolate bars for 50p each.

Work out Sean's percentage profit.

Percentage profit = percentage change = $(\text{new} - \text{old}) / \text{old} \times 100$.
The new value is the amount of income he gets. The old value is the amount he paid

..... %

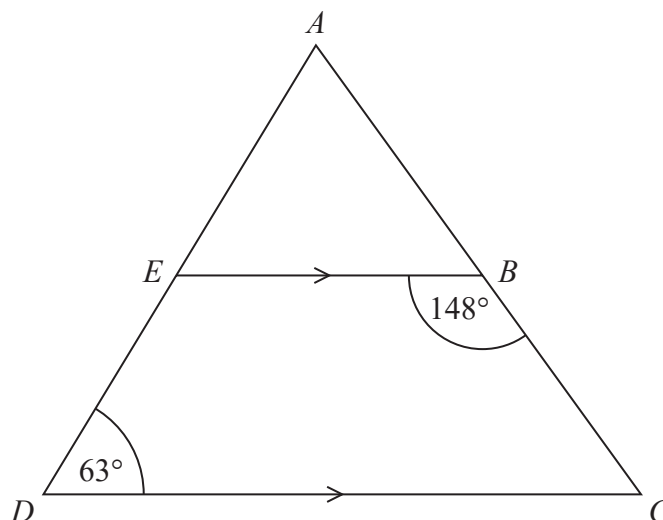
(Total for Question 5 is 3 marks)

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6 ADC is a triangle.



AED and ABC are straight lines.
 EB is parallel to DC .

Angle $EBC = 148^\circ$
Angle $ADC = 63^\circ$

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

Co-interior angles and angles in a triangle both sum to 180

(Total for Question 6 is 5 marks)

- 7 The table shows information about the heights, in cm, of a group of Year 9 girls.

| | |
|-----------------|--------|
| least height | 150 cm |
| median | 165 cm |
| greatest height | 170 cm |

This stem and leaf diagram shows information about the heights, in cm, of a group of 15 Year 9 boys.

| | |
|----|-----------|
| 15 | 8 9 9 |
| 16 | 4 5 7 7 8 |
| 17 | 0 3 4 4 7 |
| 18 | 0 2 |

Key: 15 | 8 represents 158 cm

Compare the distribution of the heights of the girls with the distribution of the heights of the boys.

The medians and ranges need to be compared and backed up with figures. The formula $(n + 1)/2$, where n is the number of boys, can be used to work out which value is the median for the boys. They are arranged in order in the stem and leaf diagram so we can count to this value from the top left to the bottom right. Range = greatest - least

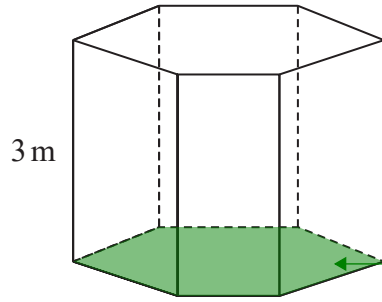
(Total for Question 7 is 3 marks)

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8 The diagram shows a prism placed on a horizontal floor.



$$\text{pressure} = \frac{\text{force}}{\text{area}}$$

This is the cross sectional area, the area in contact with the floor

The prism has height 3 m
 The volume of the prism is 18 m^3

The pressure on the floor due to the prism is 75 newtons/m^2

Work out the force exerted by the prism on the floor.

Rearrange to make the force the subject of the formula by multiplying both sides by the area.
 Volume of prism = cross sectional area x length

..... newtons

(Total for Question 8 is 3 marks)

9 Write these numbers in order of size.
 Start with the smallest number.

6.72×10^5 67.2×10^{-4} 672×10^4 0.000672

Convert the numbers into ordinary form.
 $\times 10^n$ means to multiply by 10 n times
 $\times 10^{-n}$ means to divide by 10 n times

.....

(Total for Question 9 is 2 marks)

10 Given that $\frac{a}{b} = \frac{2}{5}$ and $\frac{b}{c} = \frac{3}{4}$

find $a:b:c$

a | b | c

← a could be 2 while b could be 5. b could be 3 while c could be 4. Write these as ratios in columns to see what is in common to both ratios

b should be in common to both ratios. Find a common multiple of the number of parts for b in both ratios. Multiply both sides of the first ratio and both sides of the second ratio by amounts which make the number of parts for b the same and makes it so that the ratios can be combined

.....
(Total for Question 10 is 3 marks)

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11 (a) Find the value of $\sqrt[4]{81 \times 10^8}$

This can be split into $\sqrt[4]{81} \times \sqrt[4]{10^8}$. The fourth root is the square root of the square root. The fourth root is the same as raising to the power of $1/4$ and $(a^x)^y$

.....
(2)

(b) Find the value of $64^{-\frac{1}{2}}$

To the power of $1/2$ means the positive square root. The negative means reciprocal

.....
(2)

(c) Write $\frac{3^n}{9^{n-1}}$ as a power of 3

Write the denominator as a power of 3. $9 = 3^2$

$$(a^x)^y = a^{xy} \quad a^x/a^y = a^{x-y}$$

The answer needs to be 3 to the power of something

.....
(2)

(Total for Question 11 is 6 marks)

12 The table gives information about the weekly wages of 80 people.

| Wage (£ w) | Frequency |
|--------------------|-----------|
| $200 < w \leq 250$ | 5 |
| $250 < w \leq 300$ | 10 |
| $300 < w \leq 350$ | 20 |
| $350 < w \leq 400$ | 20 |
| $400 < w \leq 450$ | 15 |
| $450 < w \leq 500$ | 10 |

(a) Complete the cumulative frequency table.

| Wage (£ w) | Cumulative frequency |
|--------------------|----------------------|
| $200 < w \leq 250$ | 5 |
| $200 < w \leq 300$ | 15 |
| $200 < w \leq 350$ | 35 |
| $200 < w \leq 400$ | |
| $200 < w \leq 450$ | |
| $200 < w \leq 500$ | |

The frequencies are added up as they go

$5 + 10$

$15 + 20$

(1)

(b) On the grid opposite, draw a cumulative frequency graph for your completed table.

(2)

Juan says

“60% of this group of people have a weekly wage of £360 or less.”

(c) Is Juan correct?

You must show how you get your answer.

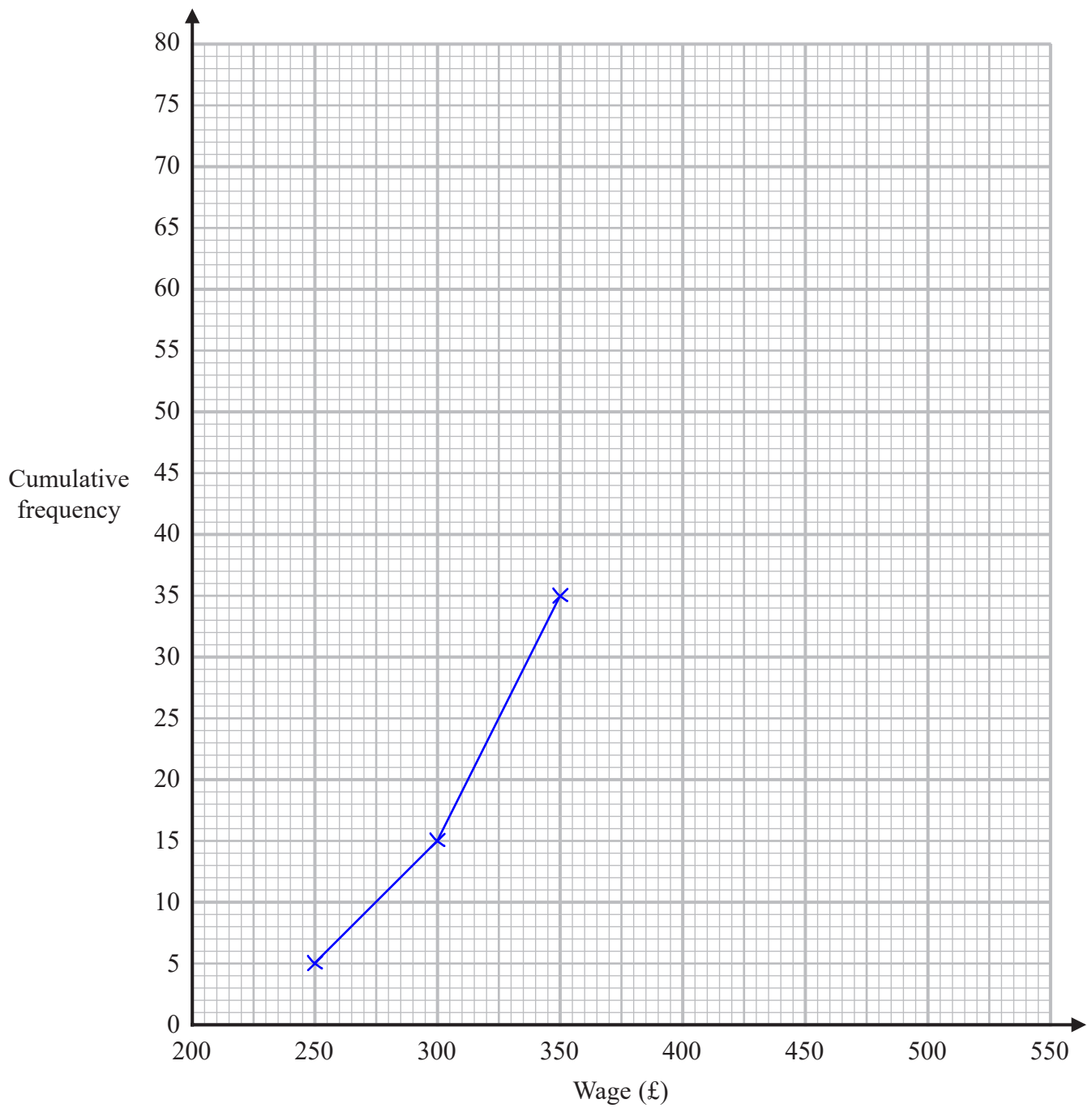
Work out 60% of 80. Use the cumulative frequency graph to estimate how many had a wage of £360 or less. Compare this to the 60% of 80. If they aren't the same, Juan is probably wrong

(3)

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(Total for Question 12 is 6 marks)

The cumulative frequencies are plotted at the end of each category. The points are joined up with a series of straight lines, which is easier than trying to do a smooth curve freehand

13 Liquid A and liquid B are mixed to make liquid C.

Liquid A has a density of 70 kg/m^3

Liquid A has a mass of 1400 kg

Liquid B has a density of 280 kg/m^3

Liquid B has a volume of 30 m^3

Work out the density of liquid C.

d m v

Writing out the formula triangle for density

density of C = mass of C / volume of C

mass of C = mass of A + mass of B

mass of B = density of B \times volume of B

volume of C = volume of A + volume of B

volume of A = mass of A / density of A

..... kg/m^3

(Total for Question 13 is 3 marks)

- 14 Sally plays two games against Martin.
In each game, Sally could win, draw or lose.

In each game they play,
the probability that Sally will win against Martin is 0.3
the probability that Sally will draw against Martin is 0.1

Work out the probability that Sally will win **exactly** one of the two games against Martin.

Win AND not win OR not win AND win.
AND means to multiply, OR means to add

.....
(Total for Question 14 is 3 marks)

- 15 The straight line L_1 has equation $y = 3x - 4$
The straight line L_2 is perpendicular to L_1 and passes through the point (9, 5)

Find an equation of line L_2

The general equation of a straight line is $y = mx + c$, where m is the gradient and c is the y -intercept. The gradient of L_2 must be the negative reciprocal of the gradient of L_1 as they are perpendicular. Rearrange to make c the subject and substitute in the coordinates (9, 5), which is in the form (x, y)

.....
(Total for Question 15 is 3 marks)

17 Make f the subject of the formula $d = \frac{3(1-f)}{f-4}$

Eliminate the denominator by multiplying both sides by it. Expand any brackets.
Collect the f terms on the same side and get rid of any other terms on that side.
Factorise the f terms to get f out and divide both sides by the resulting bracket

.....
(Total for Question 17 is 4 marks)

18 x is proportional to \sqrt{y} where $y > 0$

y is increased by 44%

Work out the percentage increase in x .

Express the percentage increase as a multiplier. The square root of the multiplier will happen to x as y is square rooted

.....%

(Total for Question 18 is 3 marks)

19 f and g are functions such that

$$f(x) = \frac{12}{\sqrt{x}} \quad \text{and} \quad g(x) = 3(2x + 1)$$

(a) Find $g(5)$

$$3(2(5) + 1) \leftarrow \text{Substituting } x \text{ for } 5 \text{ in } g(x)$$

(1)

(b) Find $gf(9)$

Substitute 9 for x in $f(x)$. Then substitute the result for x in $g(x)$

(2)

(c) Find $g^{-1}(6)$

Find the inverse function $g^{-1}(x)$ by switching $g(x)$ with x and x with y , as inverse functions basically switch the x and y variables, then rearrange to find y . $y = g^{-1}(x)$. Then substitute 6 for x in $g^{-1}(x)$

(2)

(Total for Question 19 is 5 marks)

20 Show that $\frac{\sqrt{180} - 2\sqrt{5}}{5\sqrt{5} - 5}$ can be written in the form $a + \frac{\sqrt{5}}{b}$ where a and b are integers.

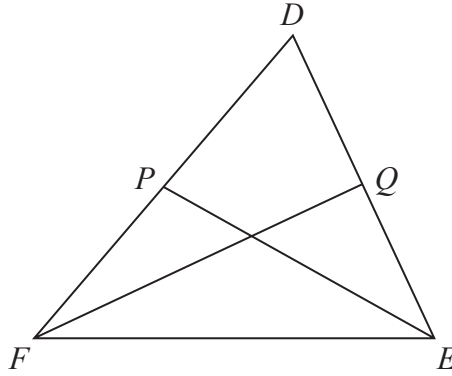
$\sqrt{180}$ must simplify to something $\sqrt{5}$ as the answer has $\sqrt{5}$ as the only surd.

$\sqrt{ab} = \sqrt{a} \times \sqrt{b}$ so we can work out what surd multiplies by $\sqrt{5}$ to get $\sqrt{180}$

Rationalise the denominator by switching the sign from - to + on the denominator and multiply by the result/the result. Rationalising the denominator: $x/(\sqrt{y} - z) \times (\sqrt{y} + z)/(\sqrt{y} + z)$. This will cancel out the surds on the denominator. The resulting fraction, once simplified, can be split from $(x + y)/z$ to $x/z + y/z$

(Total for Question 20 is 4 marks)

21 DEF is a triangle.



P is the midpoint of FD .
 Q is the midpoint of DE .

$$\vec{FD} = \mathbf{a} \quad \text{and} \quad \vec{FE} = \mathbf{b}$$

Use a vector method to prove that PQ is parallel to FE .

$$\vec{PQ} = \vec{PD} + \vec{DQ}$$

Show that \vec{PQ} is only in terms of \mathbf{b} and not \mathbf{a}

They both only in terms of \mathbf{b}

So they must be parallel as \vec{PQ}
and \vec{FE} are in the same direction

(Total for Question 21 is 4 marks)

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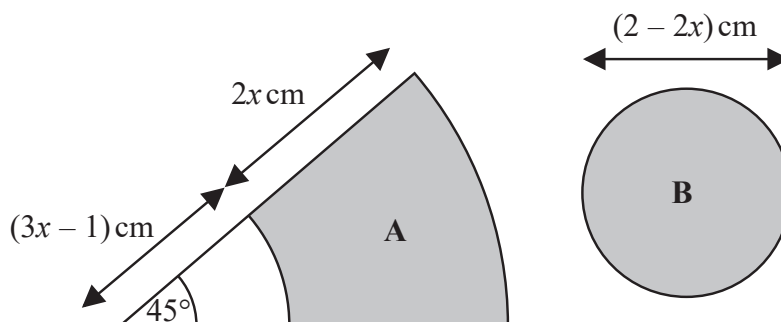
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22 The diagram shows two shaded shapes, A and B.

Shape A is formed by removing a sector of a circle with radius $(3x - 1)$ cm from a sector of the circle with radius $(5x - 1)$ cm.

Shape B is a circle of diameter $(2 - 2x)$ cm.



The area of shape A is equal to the area of shape B.

Find the value of x .

You must show all your working.

Area of sector = $\frac{y}{360} \times \pi r^2$, where y is the angle of the sector and r is the radius. Area of circle = πr^2 . The radius of B is half of its diameter.

Set the area of A equal to the area of B. Expand any square brackets: square the first term, double the product of both terms, square the last term. Eliminate any fractions by multiplying both sides by the denominator. Bring into the quadratic form $ax^2 + bx + c = 0$ so it can be solved using factorisation.

x must be positive as it is a length

(Total for Question 22 is 5 marks)

23 There are four types of cards in a game.

Each card has a black circle or a white circle or a black triangle or a white triangle.



number of cards with a black shape : number of cards with a white shape = 3:5

number of cards with a circle : number of cards with a triangle = 2:7

Express the total number of cards with a black shape as a fraction of the total number of cards with a triangle.

3 out of the 8 parts in the ratio of the colours are black shapes. 7 out of the 9 parts in the ratio of the shapes are triangles. Express the fraction of the cards with a black shape as a fraction of the fraction of the cards with a triangle. Fractions can be divided using keep, change, flip. Fractions can be multiplied by multiplying the numerators and the denominators

(Total for Question 23 is 3 marks)

TOTAL FOR PAPER IS 80 MARKS