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

Centre Number

Candidate Number

Mathematics
Paper 1 (Non-Calculator)

Higher Tier

Thursday 24 May 2018 – Morning
Time: 1 hour 30 minutes

Paper Reference
1MA1/1H

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 ▶

.CG Maths.
Worked Solutions

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.

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) Work out $2\frac{1}{7} + 1\frac{1}{4}$

$$\frac{15}{7} + \frac{5}{4}$$

Converting the mixed numbers into improper fractions by multiplying the whole number by the denominator then adding the result to the numerator

$$\frac{60}{28} + \frac{35}{28}$$

Converting the fractions into equivalent fractions with the same denominators

$$\frac{95}{28}$$

(2)

(b) Work out $1\frac{1}{5} \div \frac{3}{4}$

Give your answer as a mixed number in its simplest form.

$$\frac{6}{5} \times \frac{4}{3}$$

Converting the mixed number into an improper fraction by multiplying the whole number by the denominator then adding the result to the numerator. Changing the sign to multiplication and flipping the second fraction

$$\frac{24}{15} = \frac{8}{5}$$

Multiplying the numerators and denominators to get 24/15. Simplifying by dividing both the numerator and denominator by 3

8 ÷ 5 = 1 remainder 3

$$1\frac{3}{5}$$

(2)

(Total for Question 1 is 4 marks)

2

.CG Maths.

2   In a village

the number of houses and the number of flats are in the ratio 7 : 4
the number of flats and the number of bungalows are in the ratio 8 : 5

There are 50 bungalows in the village.

How many houses are there in the village?

$$5p = 50$$

5 parts of the ratio 8:5 is for bungalows and there are 50 of these

$$P = 10$$

Divide both sides by 5 to work out what 1 part of the ratio is worth

$$8p = 80$$

Multiply by 8 to work out the worth of the 8 parts. This is the number of flats

$$4q = 80$$

4 parts of the ratio 7:4 is for the flats

$$q = 20$$

Divide both sides by 4 to work out what 1 part of the ratio is worth

$$7q = 140$$

Multiply by 7 to work out the worth of the 7 parts. This is the number of houses

140

(Total for Question 2 is 3 marks)

.CG Maths.

3 Renee buys 5 kg of sweets to sell.
She pays £10 for the sweets.

Renee puts all the sweets into bags.
She puts 250 g of sweets into each bag.
She sells each bag of sweets for 65p.

Renee sells all the bags of sweets.

Work out her percentage profit.

$$250 \overline{)5000} = 20$$

There are 1000g in 1kg so 5kg is 5000g. 20 lots of 250g go into 5000g so she sells 20 bags

$$\begin{array}{r} 0.65 \\ \times 20 \\ \hline 13.00 \end{array}$$

20 lots of £0.65 is £13. This is how much money she gets by selling the sweets

$$13 - 10 = 3$$

Subtracting the costs of £10 works out that her profit is £3

$$\frac{3}{10} \times 100$$

Expressing the profit as a fraction of the costs then multiplying by 100 to convert it to a percentage

30 %

(Total for Question 3 is 4 marks)

.CG Maths.

4 A cycle race across America is 3069.25 miles in length.

Juan knows his average speed for his previous races is 15.12 miles per hour.
For the next race across America he will cycle for 8 hours per day.

(a) Estimate how many days Juan will take to complete the race.

$$\frac{d}{s \mid t}$$

From the formula triangle, time = distance/speed

$$\begin{array}{r} 200 \\ 15\overline{)3000} \end{array}$$

The distance is roughly 3000 miles and the speed is roughly 15 miles per hour. This calculates that the time needed is about 200 hours

$$\begin{array}{r} 25 \\ 8\overline{)200} \end{array}$$

Working out how many lots of 8 hours 200 hours is

.... 25 ....

(3)

Juan trains for the race.
The average speed he can cycle at increases.
It is now 16.27 miles per hour.

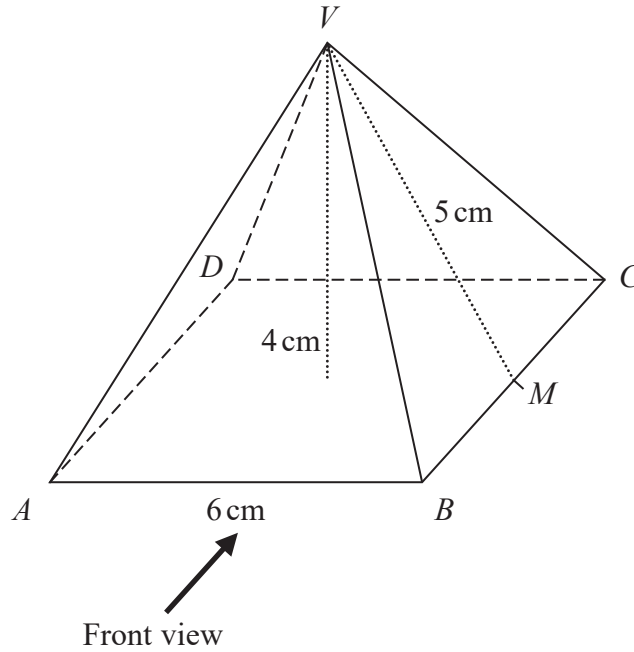(b) How does this affect your answer to part (a)?

It will take less time

As the speed is higher and time = distance/speed, dividing by more will decrease the time
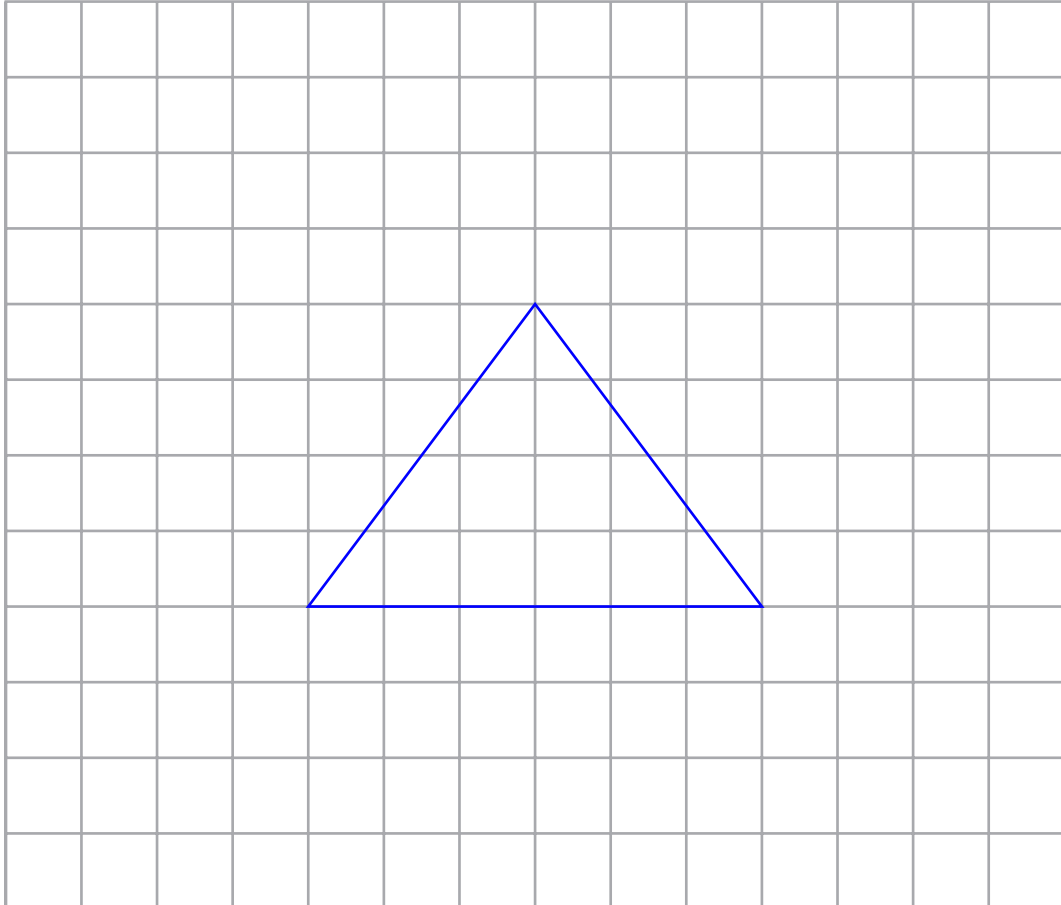
(1)

(Total for Question 4 is 4 marks)

5 Here is a solid square-based pyramid, *VABCD*.

Front view

The base of the pyramid is a square of side 6 cm.
The height of the pyramid is 4 cm.
M is the midpoint of *BC* and *VM* = 5 cm.

(a) Draw an accurate front elevation of the pyramid from the direction of the arrow.

(2)

.CG Maths.

(b) Work out the total surface area of the pyramid.

$$6^2 + 4\left(\tfrac{1}{2} \times 6 \times 5\right)$$

Area of the square is length squared

Area of the four triangles. 1/2 x base x height = area of a triangle

$$36 + 60$$

6 x 6 = 36
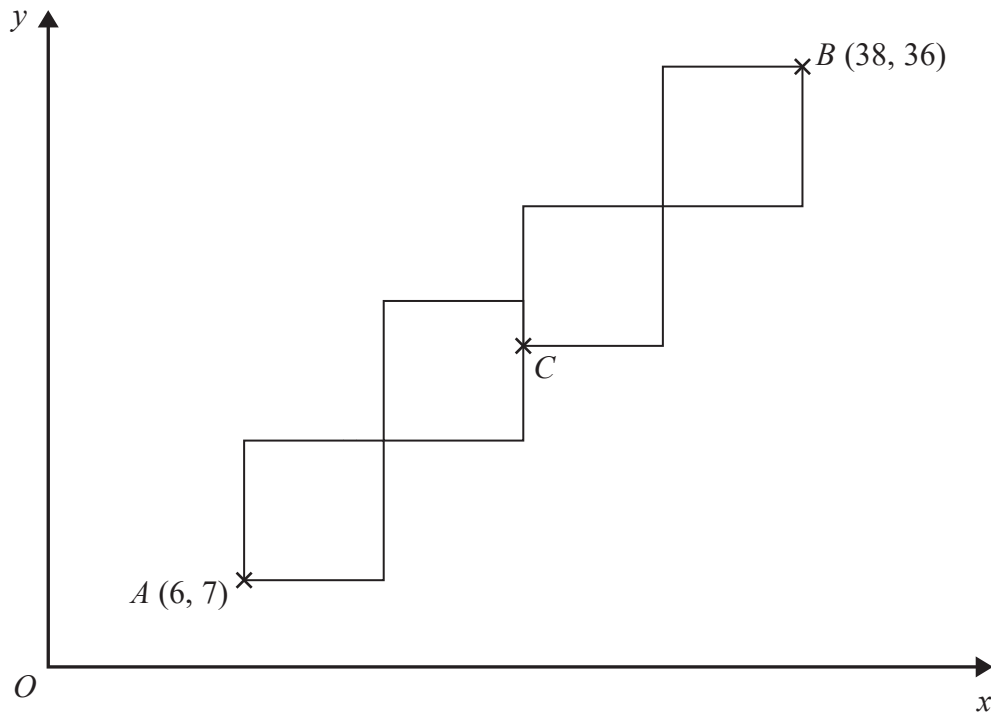1/2 x 6 = 3
3 x 5 = 15
15 x 4 = 60

$96cm^2$

(4)

(Total for Question 5 is 6 marks)

.CG Maths.

6 A pattern is made from four identical squares.

The sides of the squares are parallel to the axes.

Point *A* has coordinates (6, 7)
Point *B* has coordinates (38, 36)
Point *C* is marked on the diagram.

Work out the coordinates of *C*.

$38 - 6 = 32$

The difference in the x coordinates of points A and B gives the distance between them in the x direction

$32 \div 4 = 8$

4 squares are the same length as 32. So dividing by 4 works out the length of one of the squares
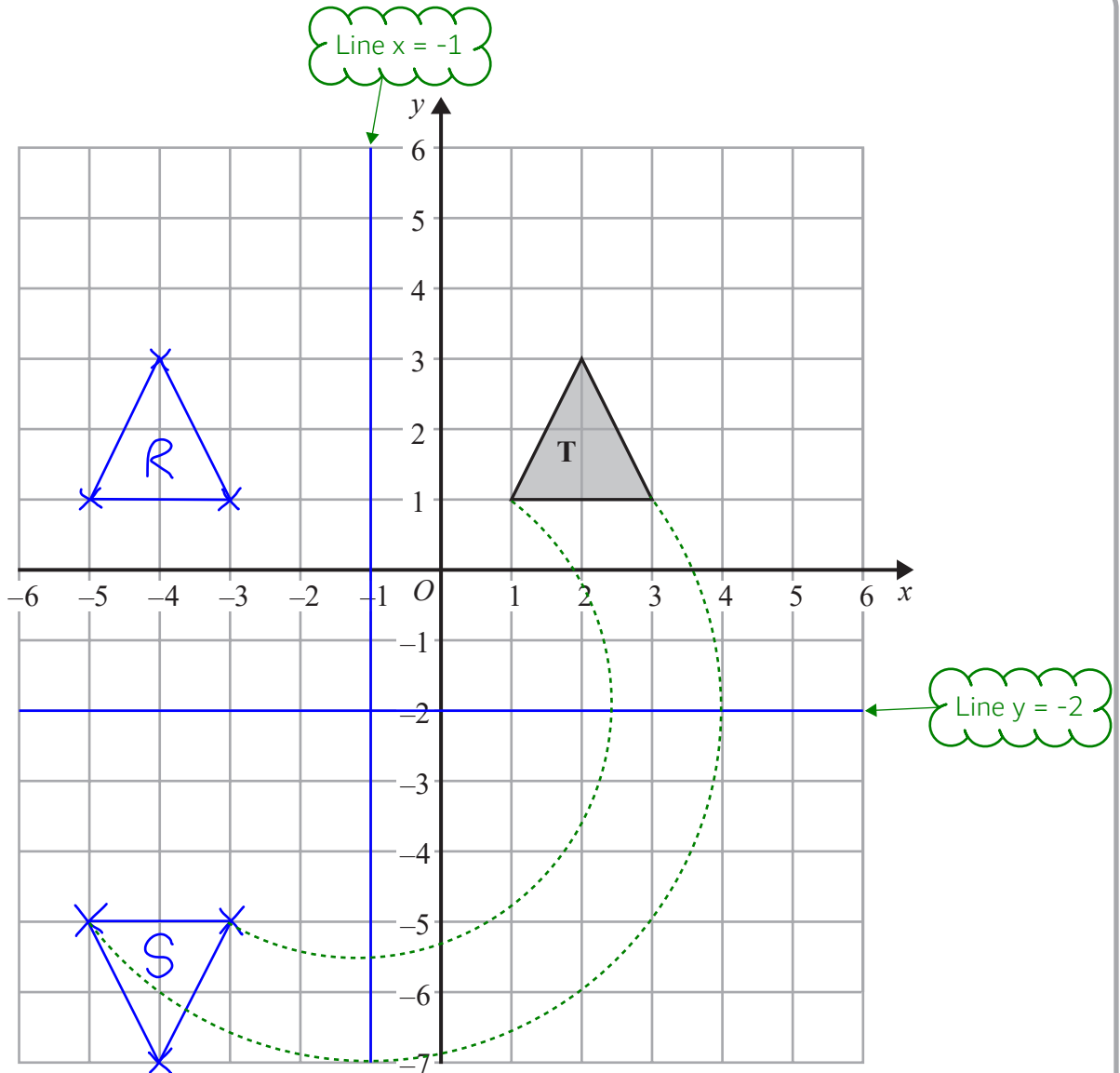
$38 - 8 \times 2 = 22$

C is two squares to the left of B

$36 - 8 \times 2 = 20$

C is two squares down from B

(22 , 20)

(Total for Question 6 is 5 marks)

.CG Maths.

Line x = -1

Line y = -2

Shape **T** is reflected in the line $x = -1$ to give shape **R**.
Shape **R** is reflected in the line $y = -2$ to give shape **S**.

Describe the **single** transformation that will map shape **T** to shape **S**.

Rotation by 180 degrees about (-1 , -2)

Use tracing paper to work out
what point it is rotating about

(Total for Question 7 is 2 marks)

.CG Maths.

8 The perimeter of a right-angled triangle is 72 cm.
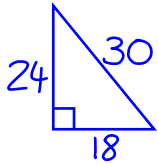The lengths of its sides are in the ratio 3 : 4 : 5

Work out the area of the triangle.

$12p = 72$

3 + 4 + 5 = 12 so there are 12 parts in total in the ratio. These represent the perimeter of 72cm

$p = 6$

Dividing by 12 works out that 1 part is worth 6cm

3 x 6 = 18, 4 x 6 = 24, 5 x 6 = 30. These are the lengths of the sides on the triangle. The longest side is opposite the right angle

$\frac{1}{2} \times 18 \times 24$

1/2 x base x height = area of triangle

$\begin{array}{r} 24 \\ \times\ 9 \\ \hline 2\,1\,6 \end{array}$

1/2 x 18 = 9

216 cm²

(Total for Question 8 is 4 marks)

.CG Maths.

9 (a) Write down the value of $36^{\frac{1}{2}}$

To the power of 1/2 means positive square root

.... 6 ....

(1)

(b) Write down the value of 23^0

Anything to the power of 0 is 1

.... 1 ....

(1)

(c) Work out the value of $27^{-\frac{2}{3}}$

The over 3 means cube root. Cube root of 27 is 3. The 2 means to square. 3 squared is 9. The negative means to take the reciprocal. This is 1/9
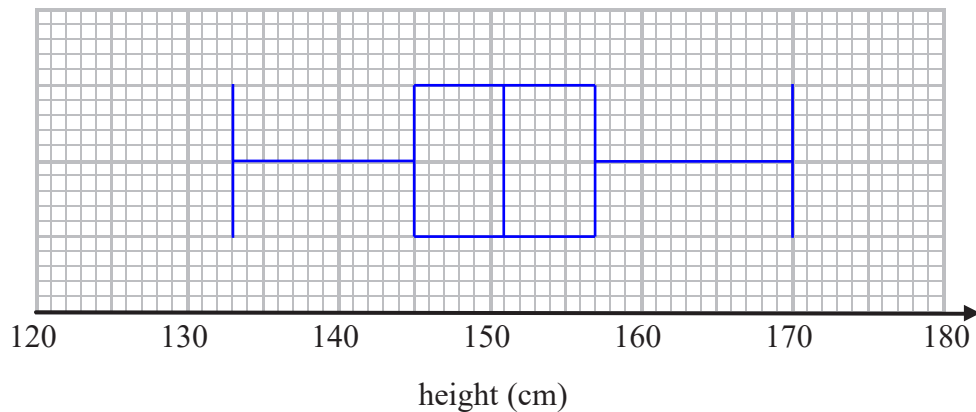
.... $\frac{1}{9}$ ....

(2)

(Total for Question 9 is 4 marks)

10 The table gives some information about the heights of 80 girls.

Least height	133 cm
Greatest height	170 cm
Lower quartile	145 cm
Upper quartile	157 cm
Median	151 cm

(a) Draw a box plot to represent this information.

height (cm)

(3)

(b) Work out an estimate for the number of these girls with a height between 133 cm and 157 cm.
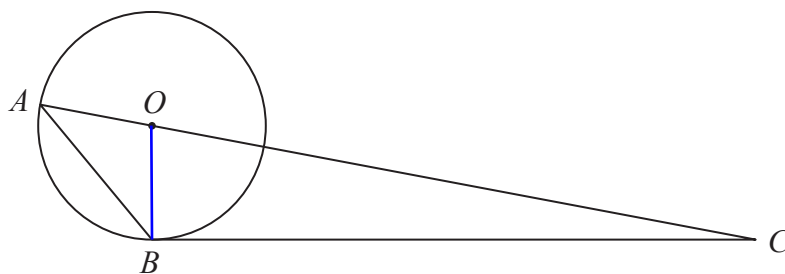
$\frac{3}{4} \times 80$

1/4 of the data is between the least and lower quartile. 1/4 of the data is between the lower quartile and median. 1/4 of the data is between the median and upper quartile. So 3/4 of the data is between 133 and 157

60

(2)

(Total for Question 10 is 5 marks)

.CG Maths.

11

A and *B* are points on a circle, centre *O*.

BC is a tangent to the circle.
AOC is a straight line.
Angle *ABO* = $x°$.

Find the size of angle *ACB*, in terms of *x*.
Give your answer in its simplest form.
Give reasons for each stage of your working.

Angle BAO is x as triangle AOB is isosceles and its base angles are equal.

It is isosceles as it has two radii and each radius is the same length

Angle OBC is 90 as the angle between a tangent and a radius is 90°.

Angle ABC is x + 90

Adding angle ABO (which is x) and angle OBC (which is 90)

180 - x - (x + 90) = 180 - 2x - 90 = 90 - 2x
Angle ACB is 90 - 2x as angles in a triangle add up to 180°

Subtracting angles BAO and ABC from 180 to find ACB

(Total for Question 11 is 5 marks)

.CG Maths.

12 Prove that the square of an odd number is always 1 more than a multiple of 4

$(2n+1)^2$ ← 2n is an even number. Adding 1 makes it odd

$4n^2 + 4n + 1$ ← Expanding the square bracket using square the first term, double the product of the two terms, square the last term

$4(n^2+n) + 1$ ← Bringing out 4 as a factor shows the first part is a multiple of 4. Adding 1 shows it is 1 more than a multiple of 4

(Total for Question 12 is 4 marks)

13 $\sqrt{5}(\sqrt{8} + \sqrt{18})$ can be written in the form $a\sqrt{10}$ where a is an integer.

Find the value of a.

$\sqrt{40} + \sqrt{90}$ ← $\sqrt{a} \times \sqrt{b} = \sqrt{ab}$
Expanding the brackets.
5 x 8 = 40
5 x 18 = 90

$\sqrt{4} \times \sqrt{10} + \sqrt{9} \times \sqrt{10}$ ← Simplifying the surds by bringing out a surd which can be square rooted to give a whole number

$2\sqrt{10} + 3\sqrt{10}$ ← Root 4 = 2
Root 9 = 3

$5\sqrt{10}$

$a = $ .... 5 ....

(Total for Question 13 is 3 marks)

14

14 y is inversely proportional to d^2
When $d = 10$, $y = 4$

d is directly proportional to x^2
When $x = 2$, $d = 24$

Find a formula for y in terms of x.
Give your answer in its simplest form.

$$y = \frac{k}{d^2}$$

Converting 'y is inversely proportional to d^2' into an equation

$$k = yd^2 = 4 \times 10^2 = 400$$

Rearranging to find k and substituting d for 10 and y for 4

$$y = \frac{400}{d^2}$$

Substituting k for 400 in the original equation

$$d = cx^2$$

Converting 'd is directly proportional to x^2' into an equation

$$c = \frac{d}{x^2} = \frac{24}{2^2} = 6$$

Rearranging to find c and substituting x for 2 and d for 24

$$d = 6x^2$$

Substituting c for 6 in the original equation

$$y = \frac{400}{(6x^2)^2} = \frac{400}{36x^4}$$

Substituting d for $6x^2$ in the equation y = 400/d^2 then resolving the square bracket

Dividing the numerator and denominator by 4 to simplify the fraction

$$y = \frac{100}{9x^4}$$

(Total for Question 14 is 5 marks)

.CG Maths.

15 (a) Factorise $a^2 - b^2$

Difference of two squares

$$(a+b)(a-b)$$

(1)

(b) Hence, or otherwise, simplify fully $(x^2 + 4)^2 - (x^2 - 2)^2$

$a = x^2 + 4$ and $b = x^2 - 2$
Substituting these into $(a + b)(a - b)$

$$(x^2+4+x^2-2)(x^2+4-(x^2-2))$$

$$(2x^2+2)(6)$$

$$12x^2+12$$

(3)

(Total for Question 15 is 4 marks)

16 There are only red counters, blue counters and purple counters in a bag.
The ratio of the number of red counters to the number of blue counters is 3 : 17

Sam takes at random a counter from the bag.
The probability that the counter is purple is 0.2

Work out the probability that Sam takes a red counter.

$$1-0.2=0.8$$

This works out the probability of getting red or blue

$$20p=0.8$$

There are 20 parts in total in the ratio.
These represent the probability of 0.8

$$p=0.04$$

Divide by 20 to work out 1 part of the ratio.
$0.8 \div 2 = 0.4$
$0.4 \div 10 = 0.04$

3 parts represent red so multiply 0.04 by 3

$$0.12$$

(Total for Question 16 is 3 marks)

.CG Maths.

17 Simplify fully $\dfrac{3x^2 - 8x - 3}{2x^2 - 6x}$

$3x^2 - 9x + x - 3$

3 x -3 = -9 so we are looking for two numbers which multiply to -9 and add to -8. -9 and 1 do this so we split the middle term into -9x and x

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

Factorise the left two terms and right two terms
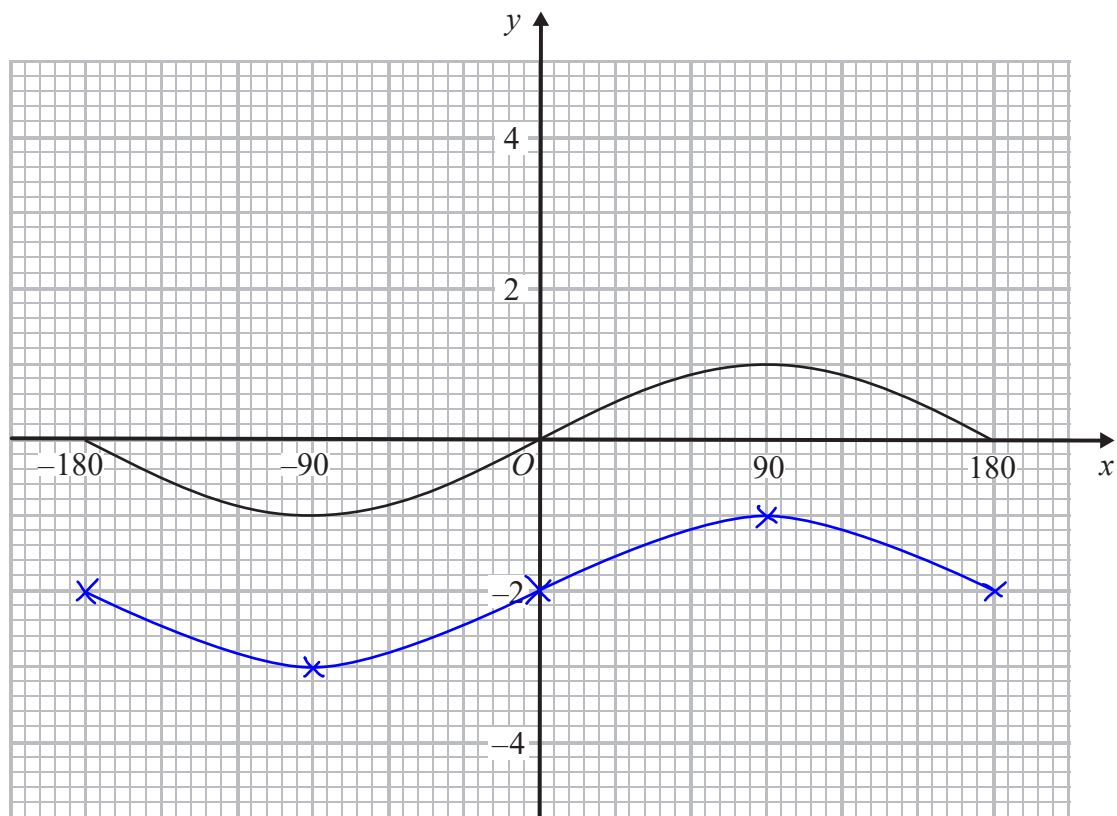
$\dfrac{(3x+1)(x-3)}{2x(x-3)}$

Express the fully factorised numerator and bring out 2x as a factor to factorise the denominator

Cancel out (x - 3) as it is a common factor in the numerator and denominator

$\dfrac{3x+1}{2x}$

(Total for Question 17 is 3 marks)

.CG Maths.

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

On the grid, sketch the graph of $y = \sin x° - 2$ for $-180 \leqslant x \leqslant 180$

Subtract 2 from each of the y values for each x value. This translates the graph down 2

(Total for Question 18 is 2 marks)

.CG Maths.

19 The point P has coordinates $(3, 4)$
The point Q has coordinates (a, b)

A line perpendicular to PQ is given by the equation $3x + 2y = 7$

Find an expression for b in terms of a.

$2y = -3x + 7$

Rearranging the equation into the form y = mx + c, where m is the gradient and c is the y intercept

$y = -\frac{3}{2}x + \frac{7}{2}$

$y = \frac{2}{3}x + C$

The gradient of the perpendicular line is -3/2. So the gradient of PQ is the negative reciprocal, which is 2/3

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

Rearranging to find c

$= 4 - \frac{2}{3}(3) = 2$

Substituting in the x and y value from point P.
2/3 x 3 = 6/3 = 2
4 - 2 = 2

The equation is y = 2/3 *x* + 2.
As a is the x coordinate and b is the y coordinate, we can substitute these for x and y

$b = \frac{2}{3}a + 2$

(Total for Question 19 is 5 marks)

.CG Maths.

20 n is an integer such that $3n + 2 \leqslant 14$ and $\dfrac{6n}{n^2 + 5} > 1$

Find all the possible values of n.

$3n \leqslant 12$

Rearranging the first inequality to solve for n
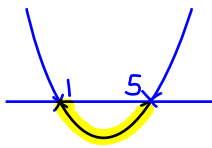
$n \leqslant 4$

$6n > n^2 + 5$

Rearranging the second inequality into the quadratic form

$0 > n^2 - 6n + 5$

$0 > (n - 5)(n - 1)$

Factorising the quadratic

Drawing a sketch of the inequality to see where is is less than 0

$1 < n < 5$

From the graph, n is between 1 and 5 when it is less than 0

$1 < n \leqslant 4$

Combining both of the inequalities

These are the only integers which satisfy the inequalities

$2, 3, 4$

(Total for Question 20 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS

.CG Maths.