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 | | | | |

Tuesday 21 May 2019

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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6/7/1/1/1/

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 There are only blue cubes, red cubes and yellow cubes in a box.

The table shows the probability of taking at random a blue cube from the box.

Colour	blue	red	yellow
Probability	0.2	0.4	0.4

The number of red cubes in the box is the same as the number of yellow cubes in the box.

(a) Complete the table.

$1 - 0.2 = 0.8$ The probabilities all add up to 1 as it is certain to pick one of the colours.

$\frac{0.8}{2}$ There are the same number as red as yellow so the probabilities must be the same.

(2)

There are 12 blue cubes in the box.

(b) Work out the total number of cubes in the box.

$0.2x = 12$ Where x is the total number of cubes.

$x = \frac{12}{0.2} = \frac{120}{2}$ Rearranging and simplifying.

60

(2)

(Total for Question 1 is 4 marks)

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2 Deon needs 50 g of sugar to make 15 biscuits.

She also needs

three times as much flour as sugar
two times as much butter as sugar

Deon is going to make 60 biscuits.

(a) Work out the amount of flour she needs.

$\frac{60}{15} = 4$ Calculating how many lots of 15 are in 60 biscuits.

$4 \times 50 = 200$ Calculating how much sugar is needed. Each lot of 15 biscuits needs 50g and there are 4 lots.

3×200 There is three times as much flour as sugar.

600 g

(3)

Deon has to buy all the butter she needs to make 60 biscuits.
She buys the butter in 250 g packs.

(b) How many packs of butter does Deon need to buy?

$2 \times 200 = 400$ There is two times as much flour as sugar.

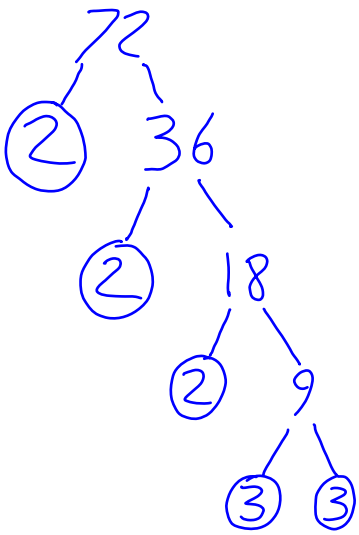
$\frac{400}{250} = 1 \text{ r } 150$ Calculating how many packs of butter are needed. There is a remainder so we need to round up.

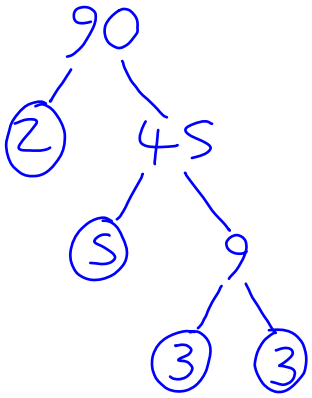
2

(2)

(Total for Question 2 is 5 marks)

3 Find the highest common factor (HCF) of 72 and 90





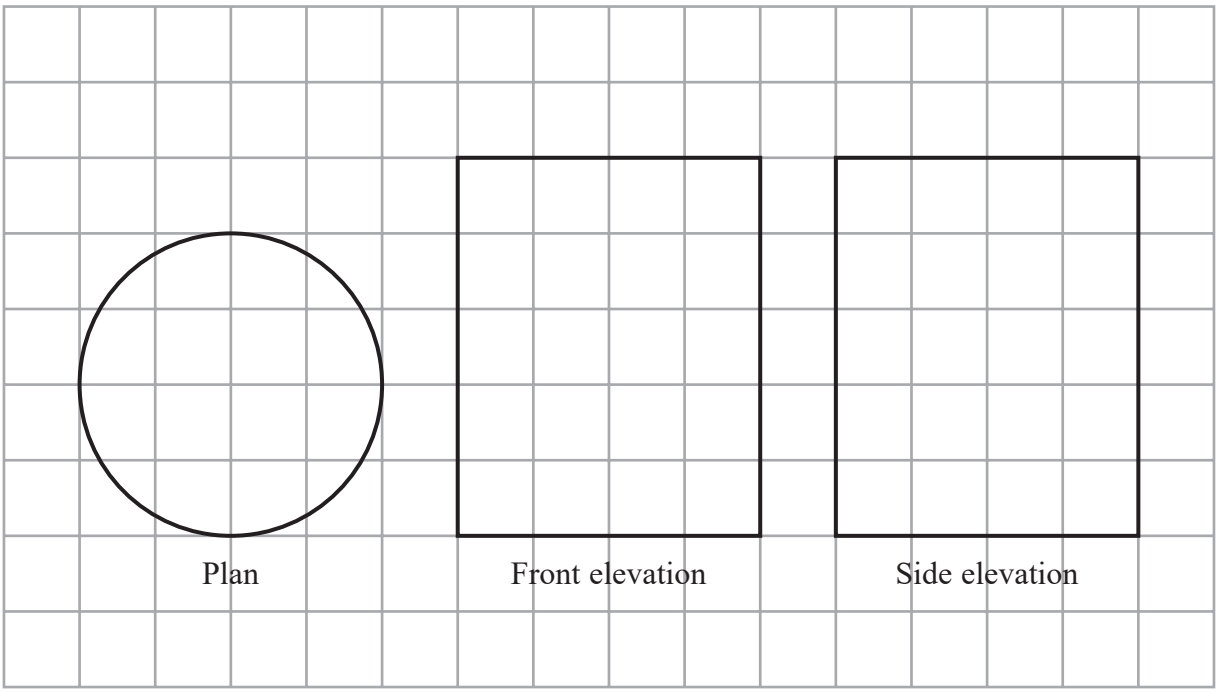
Listing factor trees to find the prime factors of both 72 and 90. Any common prime factors (2, 3 and 3) are multiplied together to get the HCF.

2 X 3 X 3

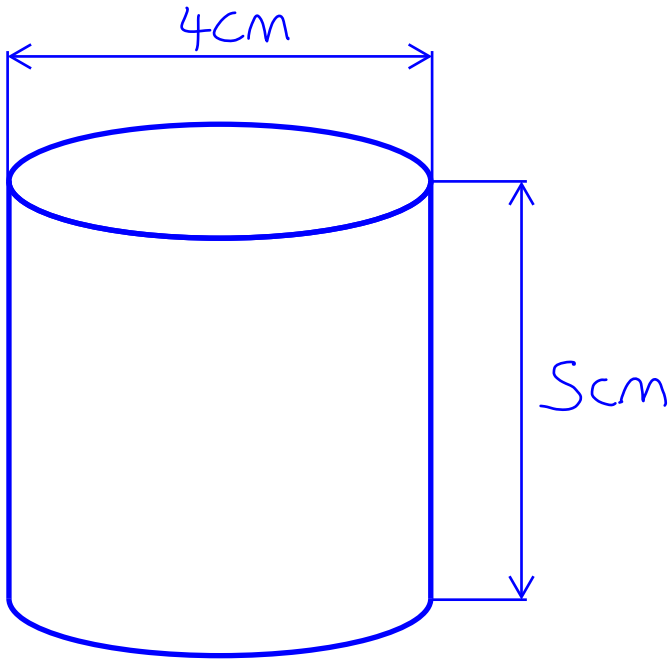
18

(Total for Question 3 is 2 marks)

4 The diagram shows the plan, front elevation and side elevation of a solid shape, drawn on a centimetre grid.

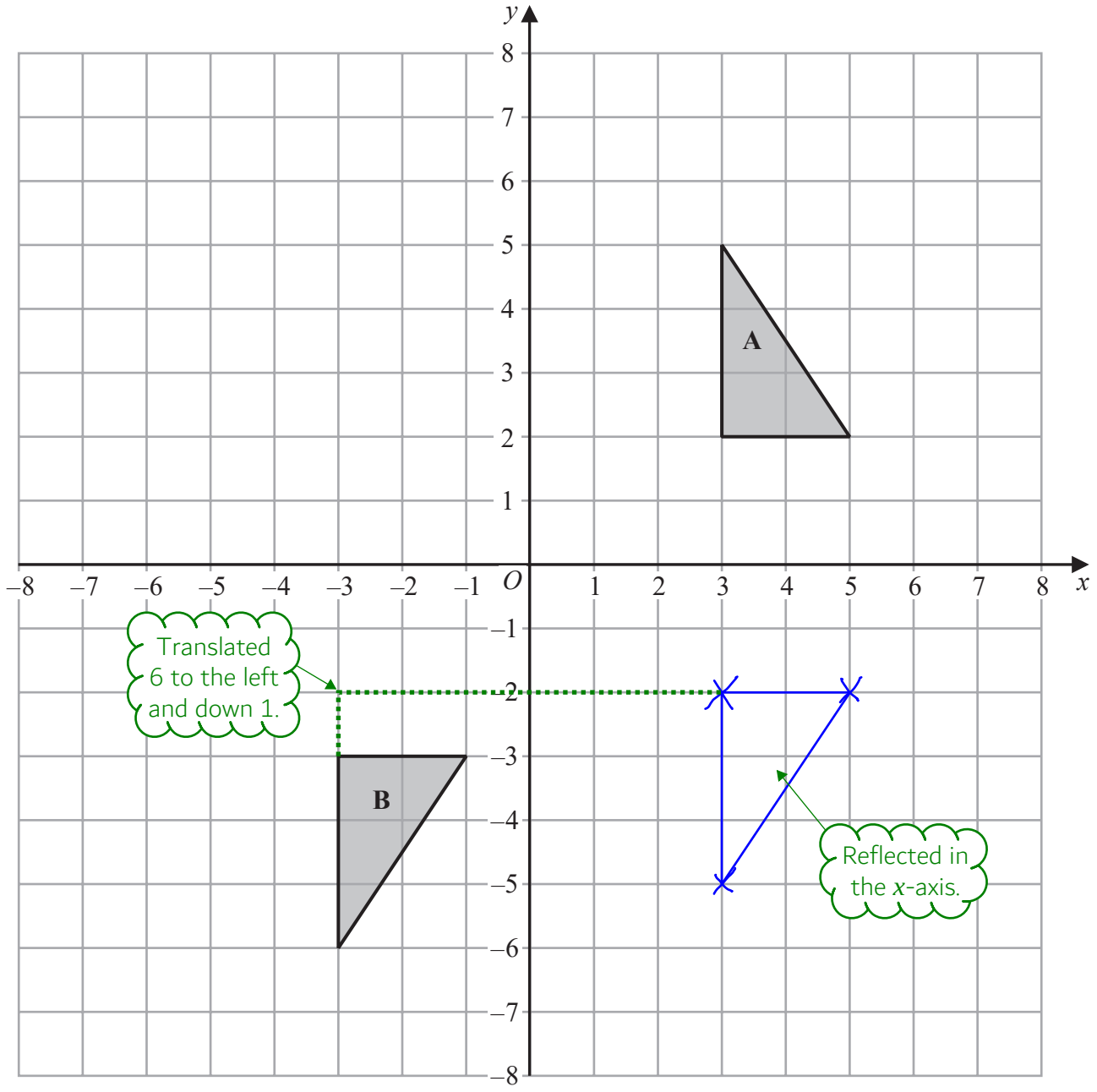


In the space below, draw a sketch of the solid shape.
Give the dimensions of the solid on your sketch.



(Total for Question 4 is 2 marks)

5



Shape **A** can be transformed to shape **B** by a reflection in the x-axis followed by a translation $\begin{pmatrix} c \\ d \end{pmatrix}$

Find the value of c and the value of d.

$c =$ -6

$d =$ -1

(Total for Question 5 is 3 marks)

6 A shop sells packs of black pens, packs of red pens and packs of green pens.

There are

2 pens in each pack of black pens
5 pens in each pack of red pens
6 pens in each pack of green pens

On Monday,

number of packs of black pens sold : number of packs of red pens sold : number of packs of green pens sold = 7 : 3 : 4

A total of 212 pens were sold.

Work out the number of green pens sold.

14 : 15 : 24

Converting the ratio in terms of the number of pens rather than number of packs.
2 x 7 = 14
5 x 3 = 15
6 x 4 = 24

```
  14
+ 15
+ 24
----
  53
```

Calculating how many parts there are in total in the ratio.

$\frac{212}{53} = 4$

Calculating what one part of the ratio is by dividing by the number of parts.

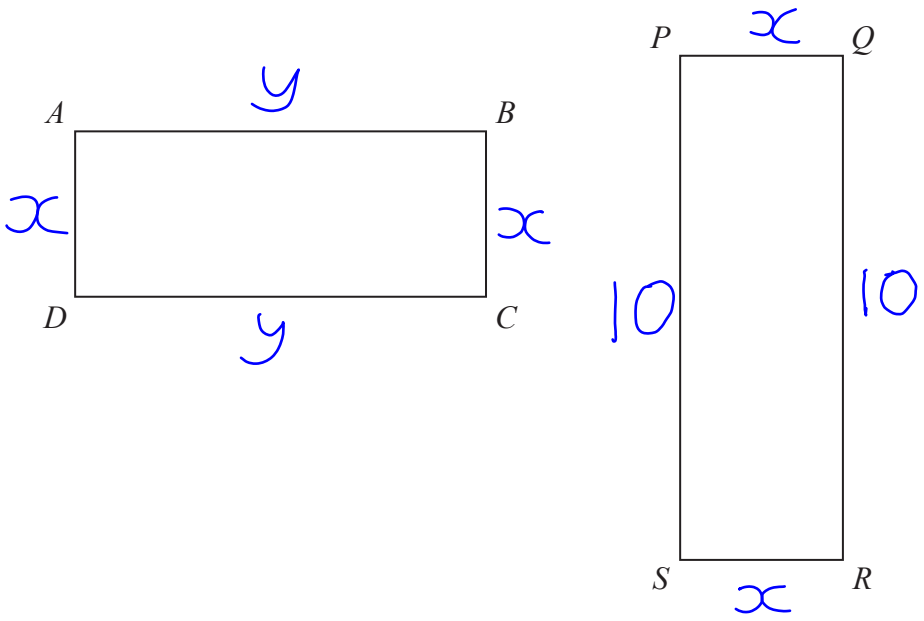
```
  24
x  4
----
  96
```

Calculating what 24 parts of the ratio are worth.

96

(Total for Question 6 is 4 marks)

7 Here are two rectangles.



$QR = 10\,\text{cm}$
$BC = PQ$

The perimeter of $ABCD$ is 26 cm
The area of $PQRS$ is $45\,\text{cm}^2$

Find the length of AB.

$10x = 45$
$x = 4.5$

Area of rectangle = base x height
base = x , height = 10
Area = 45

$2 \times 4.5 + 2y = 26$

$2y = 26 - 9$

$y = \frac{17}{2}$

The perimeter can be calculated by adding up all the sides. This creates an equation which can be rearranged to find side y.

$\frac{17}{2}$ ..... cm

(Total for Question 7 is 4 marks)

8 (a) Work out an estimate for the value of $\sqrt{63.5 \times 101.7}$

$\sqrt{64} \times \sqrt{100}$

8×10

Split the square root into two separate roots and round to the nearest square numbers so the square root can be found without a calculator.

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

80

(2)

$(2.3)^6 = 148$ correct to 3 significant figures.

(b) Find the value of $(0.23)^6$ correct to 3 significant figures.

148

Divide 148 by ten 6 times as 0.23 is ten times smaller than 2.3 and it is raised to the power of 6.

0.000148

(1)

(c) Find the value of 5^{-2}

$\frac{1}{5^2}$

$\frac{1}{25}$

(1)

(Total for Question 8 is 4 marks)

9 Work out $3\frac{1}{2} \times 1\frac{3}{5}$

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

$\frac{7}{2} \times \frac{8}{5} = \frac{56}{10} = 5\frac{6}{10}$

Convert into improper fractions, multiply the numerators and denominators then convert back into a mixed fraction. 6/10 simplifies to 3/5.

$5\frac{3}{5}$

(Total for Question 9 is 3 marks)

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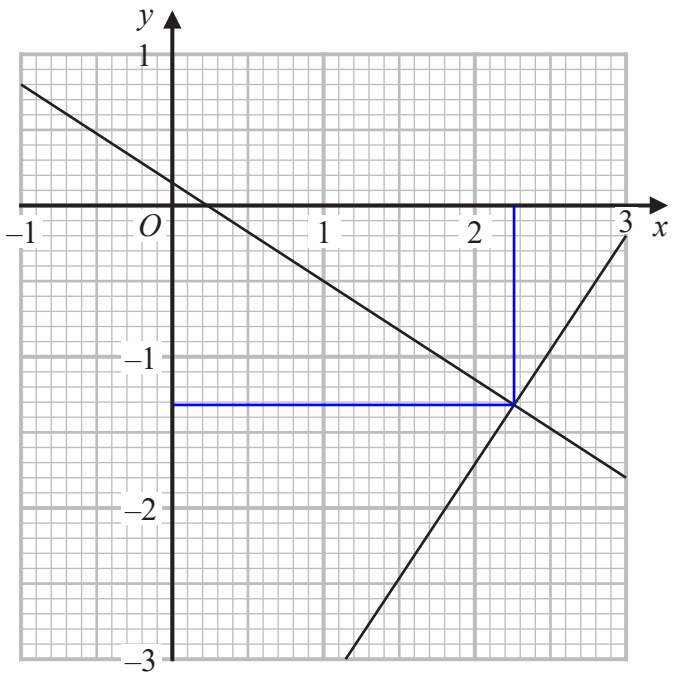
10 The graphs with equations $3y + 2x = \frac{1}{2}$ and $2y - 3x = -\frac{113}{12}$ have been drawn on the grid below.



Using the graphs, find estimates of the solutions of the simultaneous equations

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

$$2y - 3x = -\frac{113}{12}$$

The solutions are where the graphs cross.

$x =$ 2.25

$y =$ -1.3

(Total for Question 10 is 2 marks)

11 A bus company recorded the ages, in years, of the people on coach A and the people on coach B.

Here are the ages of the 23 people on coach A.

41	42	44	48	52	53	53	53	56	57	57	59
60	61	63	64	64	66	67	69	74	77	79	

(a) Complete the table below to show information about the ages of the people on coach A.

$\frac{23+1}{2} = 12$

So the 12th value is the median.

$\frac{23+1}{4} = 6$

So the 6th value is the lower quartile.

Median	59
Lower quartile	53
Upper quartile	66
Least age	41
Greatest age	79

6 x 3 = 18 so the 18th value is the upper quartile.

(2)

Here is some information about the ages of the people on coach B.

Median	70
Lower quartile	54
Upper quartile	73
Least age	42
Greatest age	85

Richard says that the people on coach A are younger than the people on coach B.

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

Yes as the median is higher for coach B

(1)

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Richard says that the people on coach A vary more in age than the people on coach B.

(c) Is Richard correct?
You must give a reason for your answer.

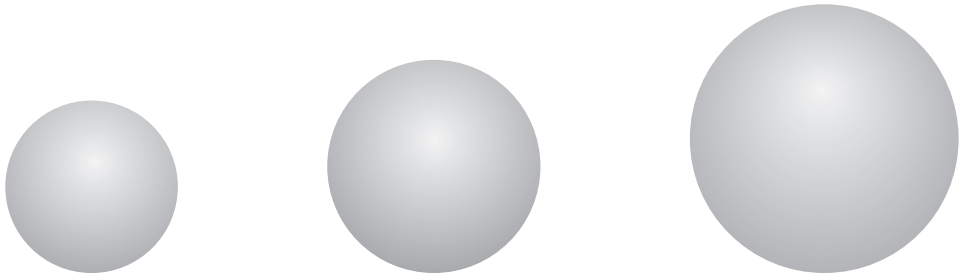
No as the range is greater for coach B

Range of A: 79 - 41 = 38
Range of B: 85 - 42 = 43

(1)

(Total for Question 11 is 4 marks)

12 Here are three spheres.



P **Q** **R**

The volume of sphere **Q** is 50% more than the volume of sphere **P**.
The volume of sphere **R** is 50% more than the volume of sphere **Q**.

Find the volume of sphere **P** as a fraction of the volume of sphere **R**.

50% more is 1 and 1/2 times more, or 3/2 times more. So dividing by 3/2 takes us back the other way.

$1 \div \frac{3}{2} = 1 \times \frac{2}{3} = \frac{2}{3}$ ← 1 represents all of the volume of sphere R. Sphere Q is 2/3 of the volume of R

$\frac{2}{3} \div \frac{3}{2} = \frac{2}{3} \times \frac{2}{3}$ ← Reducing the volume of sphere Q as a fraction of sphere R to get the volume of sphere P as a fraction of sphere R

$\frac{4}{9}$

(Total for Question 12 is 3 marks)

13 Given that n can be any integer such that $n > 1$, prove that $n^2 - n$ is never an odd number.

n is either odd or even

Odd x Odd = Odd
Odd - odd = even

even x even = even
even - even = even

(Total for Question 13 is 2 marks)

14 Find the exact value of $\tan 30° \times \sin 60°$
Give your answer in its simplest form.

$\frac{1}{\sqrt{3}} \times \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{2\sqrt{3}}$ √3 cancels out.

$\frac{1}{2}$

(Total for Question 14 is 2 marks)

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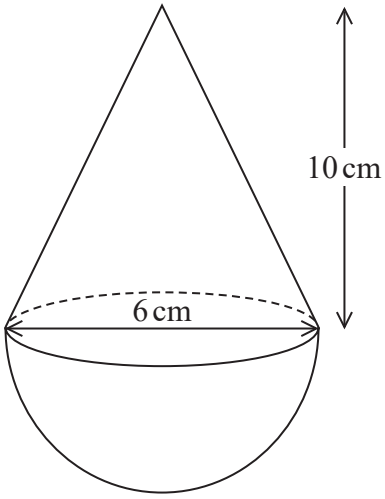
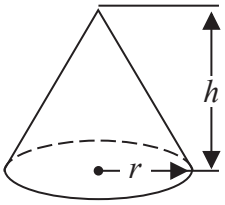
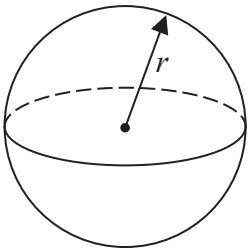
15 The diagram shows a solid shape.
The shape is a cone on top of a hemisphere.



Volume of a cone = $\frac{1}{3}\pi r^2 h$



Volume of a sphere = $\frac{4}{3}\pi r^3$



The height of the cone is 10 cm.
The base of the cone has a diameter of 6 cm.
The hemisphere has a diameter of 6 cm.

The total volume of the shape is $k\pi$ cm^3, where k is an integer.

Work out the value of k.

$\frac{1}{3}\pi \times 3^2 \times 10 + \frac{1}{2} \times \frac{4}{3}\pi \times 3^3$

Volume of the cone.

Volume of the hemisphere.

The diameter is 6cm and the radius, r, is half of this so it is 3cm.

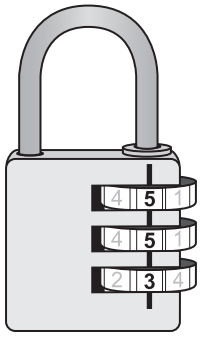
$\frac{1}{3} \times 9 \times 10\pi + \frac{2}{3} \times 27\pi$

$30\pi + 18\pi$

$k =$ 48

(Total for Question 15 is 4 marks)

16 There are three dials on a combination lock.
Each dial can be set to one of the numbers 1, 2, 3, 4, 5
The three digit number 553 is one way the dials can be set, as shown in the diagram.



(a) Work out the number of different three digit numbers that can be set for the combination lock.

5 X 5 X 5

Product rule for counting.

125

(2)

(b) How many of the possible three digit numbers have three different digits?

5 X 4 X 3

Product rule for counting. There are 5 possibilities for the first digit. For each of those possibilities there are 4 for the second digit. For each of those there are 3 for the third digit.

60

(2)

(Total for Question 16 is 4 marks)

17 Given that

$$x^2 : (3x + 5) = 1 : 2$$

find the possible values of x.

$2x^2 = 3x + 5$ ← $3x + 5$ is double x^2 so doubling x^2 makes them equal.

$2x^2 - 3x - 5 = 0$ ← Rearranging into a quadratic so it can be solved by factorisation.

$2x^2 - 5x + 2x - 5 = 0$ ← It is in the form $ax^2 + bx + c$. Multiplying a by c gives -10. Splitting the middle x-term into two numbers which multiply to -10 and add to b (-3). Factorising the first two terms and the last two terms. As there is no common factor for the last two terms, bringing 1 out as a factor. Writing it into a factorised form.

$x(2x - 5) + 1(2x - 5) = 0$

$(2x - 5)(x + 1) = 0$

$2x - 5 = 0$ or $x + 1 = 0$ ← One of the brackets must equal to 0 in order for them to multiply to 0

$\frac{5}{2}$ or -1

(Total for Question 17 is 4 marks)

18 (a) Express $\sqrt{3} + \sqrt{12}$ in the form $a\sqrt{3}$ where a is an integer.

$\sqrt{3} + \sqrt{4} \times \sqrt{3}$

$\sqrt{a} \times \sqrt{b} = \sqrt{ab}$

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

$3\sqrt{3}$

(2)

(b) Express $\left(\frac{1}{\sqrt{3}}\right)^7$ in the form $\frac{\sqrt{b}}{c}$ where b and c are integers.

$\frac{1^7}{(\sqrt{3})^7}$

$\frac{1}{27\sqrt{3}}$

1 to the power of anything is 1.
$\sqrt{3} \times \sqrt{3} \times \sqrt{3} \times \sqrt{3} \times \sqrt{3} \times \sqrt{3} \times \sqrt{3}$
$= 3 \times 3 \times 3 \times \sqrt{3}$ as $\sqrt{3} \times \sqrt{3} = 3$

Rationalise the denominator by multiplying by $\sqrt{3}/\sqrt{3}$

$\frac{\sqrt{3}}{81}$

(3)

(Total for Question 18 is 5 marks)

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19 Given that $x^2 - 6x + 1 = (x - a)^2 - b$ for all values of x,

(i) find the value of a and the value of b.

$x^2 - 2ax + a^2 - b$

Expand out the bracket on the right side of the equation.

$-2a = -6$, $a = 3$

Equate the coefficients of the x terms on both sides.

$a^2 - b = 1$

$-b = 1 - 3^2 = -8$

Equate the constants on both sides.

$a =$ 3

$b =$ 8

(2)

(ii) Hence write down the coordinates of the turning point on the graph of $y = x^2 - 6x + 1$

The right side of the equation in part (i) is in completed the square form. The minimum point occurs when $x - 3 = 0$

(3 , -8)

(1)

(Total for Question 19 is 3 marks)

20 h is inversely proportional to p
p is directly proportional to $\sqrt{t}$

Given that $h = 10$ and $t = 144$ when $p = 6$
find a formula for h in terms of t

$h \propto \frac{1}{p}$ $\quad p \propto \sqrt{t}$

Writing out the proportional relationships.

$h = \frac{k}{p}$ $\quad p = c\sqrt{t}$

Converting the proportional relationships to equations.

$k = hp$ $\quad c = \frac{p}{\sqrt{t}}$

Rearranged to find the unknown constants.

$= 10 \times 6$
$= 60$

$= \frac{6}{\sqrt{144}} = \frac{6}{12}$
$= \frac{1}{2}$

Substituting in the values of h, t and p to find the unknown constants.

$h = \frac{60}{\frac{1}{2}\sqrt{t}}$

Combining the equations by substituting p in the first equation for $c\sqrt{t}$ then substituting in the solutions for k and c

Simplifying the equation isn't required but 60/(1/2) = 120

$h = \frac{120}{\sqrt{t}}$

(Total for Question 20 is 4 marks)

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21 The functions f and g are such that

$$f(x) = 3x - 1 \quad \text{and} \quad g(x) = x^2 + 4$$

(a) Find $f^{-1}(x)$

$x = 3y - 1$

$\frac{x+1}{3} = y$

Switch f(x) for x and x for y then rearrange to make y the subject. Then switch y back for $f^{-1}(x)$.

$f^{-1}(x) =$ $\frac{x+1}{3}$

(2)

Given that $fg(x) = 2gf(x)$,

(b) show that $15x^2 - 12x - 1 = 0$

$fg(x) = 3(x^2+4) - 1$

Substitute g(x) for x in f(x) to evaluate the composite function.

$gf(x) = (3x-1)^2 + 4$

Substitute f(x) for x in g(x) to evaluate the composite function.

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

Set up the equation of $fg(x) = 2gf(x)$

$3x^2 + 12 - 1 = 2(9x^2 - 6x + 1 + 4)$

$3x^2 + 11 = 18x^2 - 12x + 10$

$0 = 15x^2 - 12x - 1$

Expand the brackets and simplify.

(5)

(Total for Question 21 is 7 marks)

22 There are only r red counters and g green counters in a bag.

A counter is taken at random from the bag.

The probability that the counter is green is $\frac{3}{7}$

The counter is put back in the bag.

2 more red counters and 3 more green counters are put in the bag.
A counter is taken at random from the bag.

The probability that the counter is green is $\frac{6}{13}$

Find the number of red counters and the number of green counters that were in the bag originally.

$\frac{g}{r+g} = \frac{3}{7}$

$\frac{g+3}{(r+2)+(g+3)} = \frac{6}{13}$

Creating two equations in terms of r (the original number of red counters) and g (the original number of green counters) so that they can be solved simultaneously.

$\frac{r+g}{g} = \frac{7}{3}$ $\quad r = \frac{7g}{3} - g$

Rearranging the first equation to make r the subject.

$\frac{g+3}{\frac{7g}{3} - g + 2 + g + 3} = \frac{6}{13}$

Substitute for r in the second equation to eliminate a variable.

$13(g+3) = 6\left(\frac{7g}{3} + 5\right)$

$13g + 39 = 14g + 30$

$39 - 30 = 14g - 13g$

$9 = g$

Rearrange, simplify and solve for g.

$r = \frac{7(9)}{3} - 9 = \frac{63}{3} - 9$

$= 21 - 9 = 12$

Substitute for g to find r.

red counters 12

green counters 9

(Total for Question 22 is 5 marks)

TOTAL FOR PAPER IS 80 MARKS