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 8 November 2018

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 ▶

6/7/7/7/7/1/

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 should be written in the exam.

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

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

Answer ALL questions.

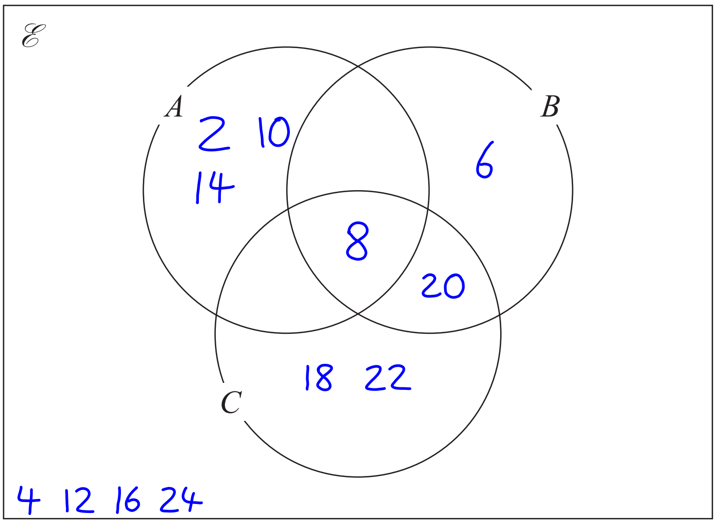
Write your answers in the spaces provided.

You must write down all the stages in your working.

1 $\mathscr{E}$ = {even numbers between 1 and 25}
A = {2, 8, 10, 14}
B = {6, 8, 20}
C = {8, 18, 20, 22}

8 is in A, B and C. 20 is in B and C

(a) Complete the Venn diagram for this information.



(4)

A number is chosen at random from $\mathscr{E}$.

(b) Find the probability that the number is a member of $A \cap B$.

The 8 is in both A and B so is in the intersection of A and B.
1 out of the 12 numbers is in the intersection of A and B

$\frac{1}{12}$

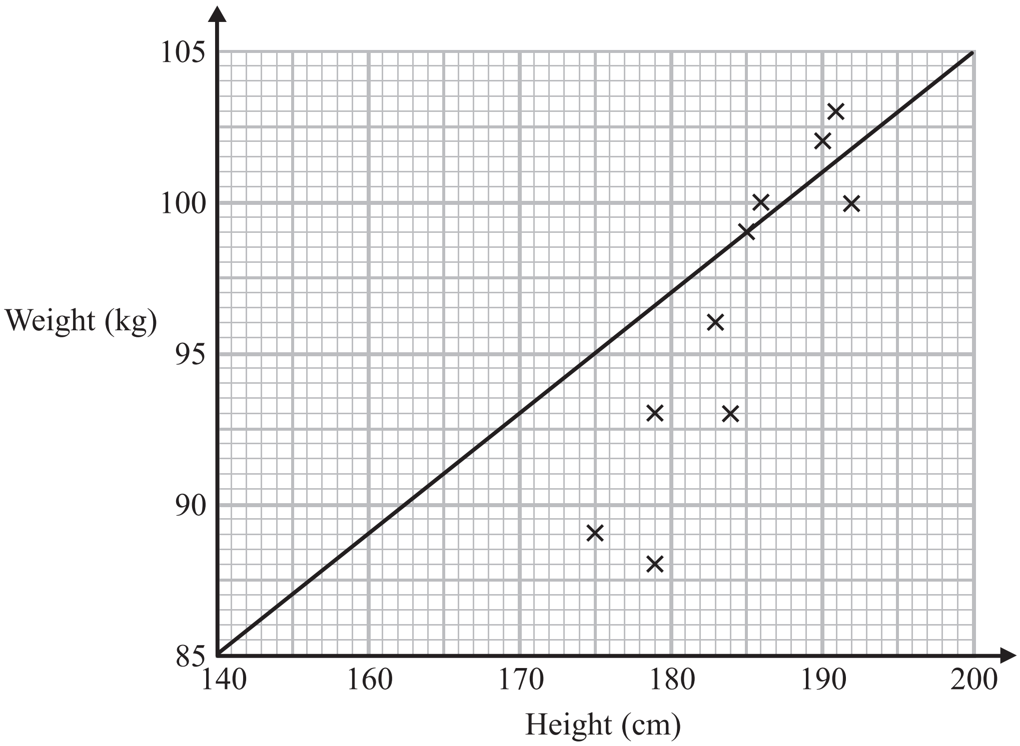
(2)

(Total for Question 1 is 6 marks)

2 Sean has information about the height, in cm, and the weight, in kg, of each of ten rugby players.

He is asked to draw a scatter graph and a line of best fit for this information.

Here is his answer.



Sean has plotted the points accurately.

Write down two things that are wrong with his answer.

1 The line of best fit is wrong It doesn't fit the correlation and has been forced through the origin

2 150 is missing on the horizontal scale It goes from 140 to 160 and misses 150

(Total for Question 2 is 2 marks)

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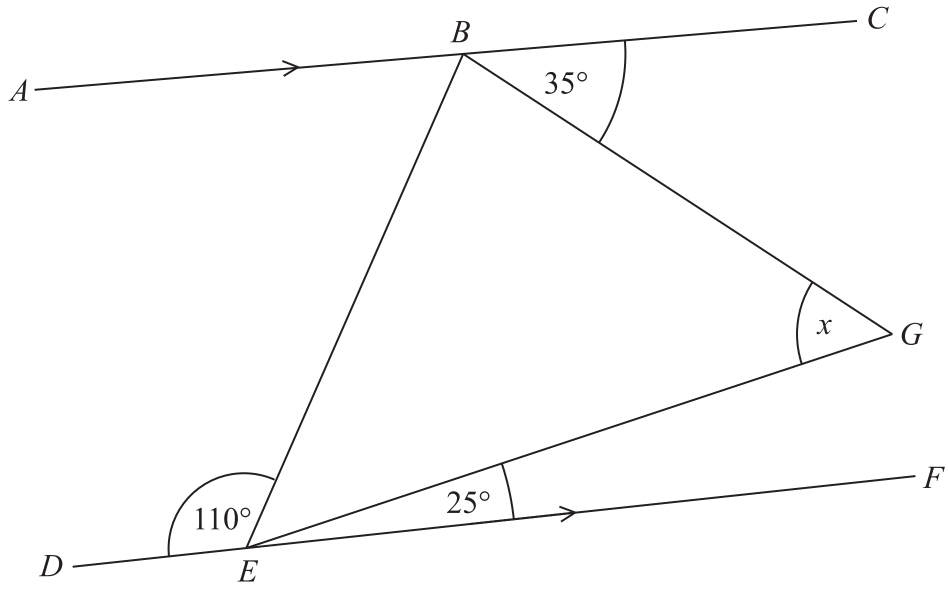
.CG Maths.

3 *BEG* is a triangle.



ABC and *DEF* are parallel lines.

Work out the size of angle x.
Give a reason for each stage of your working.

180 - 110 - 25
Angle BEG = 45° as angles around a point on a straight line add to 180°

Subtracting angle DEB and angle GEF from 180° leaves angle BEG

Angle EBC is 110° as alternate angles are equal

Angle DEB and angle EBC are alternate angles

110 - 35
Angle EBG = 75°

Subtracting angle CBG from angle EBC leaves angle EBG

180 - 45 - 75
x = 60° as angles in a triangle add to 180°

Subtracting angle EBG and angle BEG from 180° leaves angle x

60 °

(Total for Question 3 is 4 marks)

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4 Northern Bank has two types of account.
Both accounts pay compound interest.

Cash savings account	**Shares account**
Interest	Interest
2.5% per annum	3.5% per annum

Ali invests £2000 in the cash savings account.
Ben invests £1600 in the shares account.

(a) Work out who will get the most interest by the end of 3 years.
You must show all your working.

$\frac{100 + 2.5}{100}$ Adding the 2.5% to 100% expresses the percentage the cash savings account increases to each year. Putting this over 100 converts it to the decimal multiplier 1.025

2000×1.025^3 Multiplying the £2000 by 1.025^3 increases the £2000 by 2.5% 3 times. So Ali has £2153.78 at the end of 3 years

$2153.78 - 2000 = 153.78$ Subtracting the original £2000 from the £2153.78 Ali has at the end of 3 years works out that Ali receives £153.78 interest

$\frac{100 + 3.5}{100}$ Adding the 3.5% to 100% expresses the percentage the shares account increases to each year. Putting this over 100 converts it to the decimal multiplier 1.035

1600×1.035^3 Multiplying the £1600 by 1.035^3 increases the £1600 by 3.5% 3 times. So Ben has £1773.95 at the end of 3 years

$1773.95 - 1600 = 173.95$ Subtracting the original £1600 from the £1773.95 Ben has at the end of 3 years works out that Ben receives £173.95 interest

Ben Ben receives £173.95 interest, which is more than the £153.78 Ali receives

(4)

In the 3rd year the rate of interest for the shares account is changed to 4% per annum.

(b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

No as Ben will get more interest

Ben had the most interest. Giving Ben more interest will still mean than Ben has the most interest. So there is no affect

(1)

(Total for Question 4 is 5 marks)

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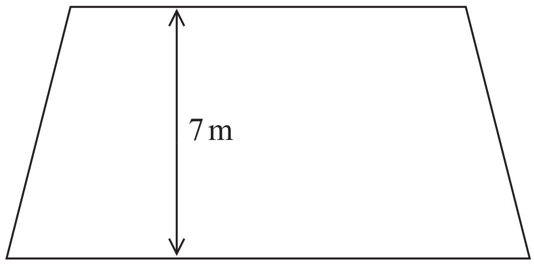
5 The diagram shows a floor in the shape of a trapezium.



John is going to paint the floor.

Each 5 litre tin of paint costs £16.99
1 litre of paint covers an area of $2\,m^2$

John has £160 to spend on paint.

Has John got enough money to buy all the paint he needs?
You must show how you get your answer.

$\frac{1}{2}(10+16)\times 7$ ← Area of trapezium = 1/2 (a + b) × h, where a and b are the parallel sides and h is the distance between them. So the area of the floor is 91 m^2

$91 \div 2$ ← Dividing the area of the floor by the 2 m^2 covered by each litre of paint works out that 45.5 litres of paint are needed

$45.5 \div 5$ ← Dividing the 45.5 litres of paint needed by the 5 litres in each tin works out that 9.1 tins of paint are needed. A whole number needs to be bought so this is rounded up to 10

$10 \times 16.99 = 169.90$ ← Multiplying the 10 tins needed by the cost of each tin works out that they will cost £169.90

NO ← The £169.90 needed is more than the £160 John has

(Total for Question 5 is 5 marks)

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6 A is the point with coordinates (5, 9)
B is the point with coordinates (d, 15)

The gradient of the line AB is 3

Work out the value of d.

$\frac{6}{x} = 3$ ← Gradient = (change in y)/(change in x). y changes from 9 to 15 so the change in y is 6. Let x be the change in x

$x = 2$ ← 6/2 = 3. So the change in x must be 2

2 more than 5 is 7

7

(Total for Question 6 is 3 marks)

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7 (a) Write the number 0.000 086 23 in standard form.

Multiplying by ten 5 times gives 8.623, which is at least 1 and less than 10. Multiplying this by 10^{-5} to keep it equal

8.623×10^{-5}

(1)

(b) Work out $\dfrac{3.2 \times 10^{3} + 5.1 \times 10^{-2}}{4.3 \times 10^{-4}}$

Give your answer in standard form, correct to 3 significant figures.

Typing into the calculator then formatting to ENG notation

$7.441\ldots \times 10^{6}$ is rounded to 3 significant figures

7.44×10^{6}

(2)

(Total for Question 7 is 3 marks)

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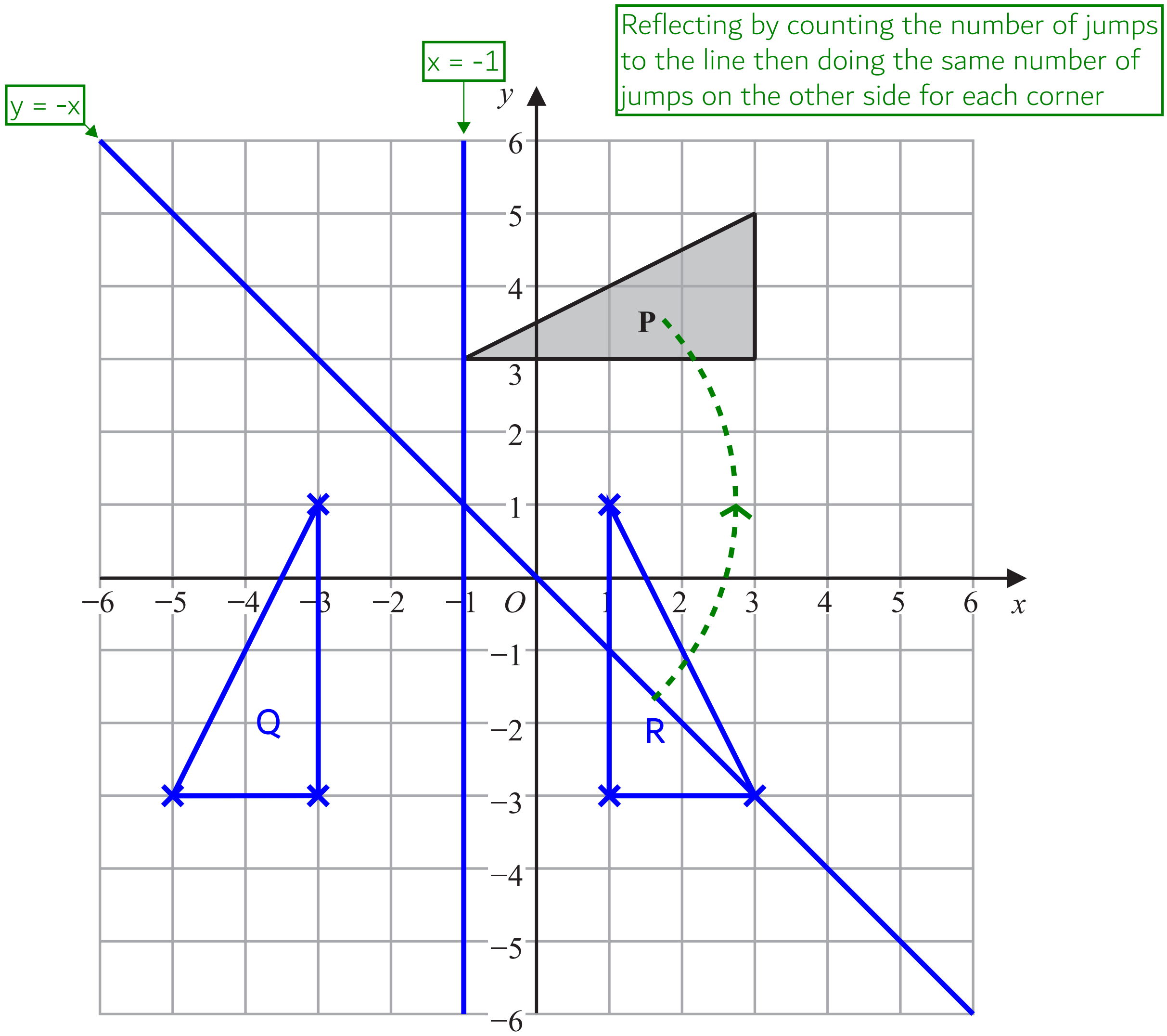
8



Triangle **P** is reflected in the line $y = -x$ to give triangle **Q**.
Triangle **Q** is reflected in the line $x = -1$ to give triangle **R**.

Describe fully the single transformation that maps triangle **R** to triangle **P**.

Rotation 90° anticlockwise centre (-1, 1)

The centre is at the centre of the circular motion. It can be checked using tracing paper

(Total for Question 8 is 3 marks)

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9 Martin truncates the number N to 1 digit.
The result is 7

Write down the error interval for N.

Truncate to 1 digit means remove all digits after the first digit without rounding. The lowest it could be and truncate to 7 is 7. The lowest it could be and truncate to 8 is 8 so it has to be less than 8

$7 \leqslant N < 8$

(Total for Question 9 is 2 marks)

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10 Robert makes 50 litres of green paint by mixing litres of yellow paint and litres of blue paint in the ratio 2 : 3

Yellow paint is sold in 5 litre tins.
Each tin of yellow paint costs £26

Blue paint is sold in 10 litre tins.
Each tin of blue paint costs £48

Robert sells all the green paint he makes in 10 litre tins.
He sells each tin of green paint for £66.96

Work out Robert's percentage profit on each tin of green paint he sells.

$26 \div 5 = 5.20$ ← Dividing the cost of a tin of yellow paint by the 5 litres in each tin works out that it costs £5.20 for each litre of yellow paint

$48 \div 10 = 4.80$ ← Dividing the cost of a tin of blue paint by the 10 litres in each tin works out that it costs £4.80 for each litre of blue paint

$10 \div 5$ ← 2 + 3 = 5 parts in total in the ratio which represent the green paint. Dividing the 10 litres in each tin of green paint by these 5 parts works out that 1 part of the ratio is worth 2 litres

$2 \times 2 = 4$ ← Multiplying the value of 1 part of the ratio by the 2 parts which represent the yellow paint works out that there are 4 litres of yellow paint in each tin of green paint

$2 \times 3 = 6$ ← Multiplying the value of 1 part of the ratio by the 3 parts which represent the blue paint works out that there is 6 litres of blue paint in each tin of green paint

$5.20 \times 4 = 20.80$ ← Multiplying the £5.20 cost of each litre of yellow paint by the 4 litres of yellow in each tin of green paint works out that the yellow paint costs £20.80

$4.80 \times 6 = 28.80$ ← Multiplying the £4.80 cost of each litre of blue paint by the 6 litres of blue in each tin of green paint works out that the blue paint costs £28.80

$20.80 + 28.80$ ← Adding the costs of the yellow and blue paint works out that the cost of making a tin of green paint is £49.60

$66.96 - 49.60$ ← Subtracting the cost of making a tin of green paint from the £66.96 which each tin of green paint is sold for works out that the profit is £17.36 for each tin of green paint

$\frac{17.36}{49.60} \times 100$ ← Putting the profit over the cost of making a tin of green paint expresses the profit as a fraction. Multiplying this by 100 converts it to a percentage

35 %

(Total for Question 10 is 5 marks)

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11 In a restaurant there are

9 starter dishes
15 main dishes
8 dessert dishes

Janet is going to choose one of the following combinations for her meal.

a starter dish and a main dish
or a main dish and a dessert dish
or a starter dish, a main dish and a dessert dish

Show that there are 1335 different ways to choose the meal.

$\underline{9 \times 15} + \underline{15 \times 8} + \underline{9 \times 15 \times 8} = 1335$

Adding all the different ways finds the total number of different ways to choose the meal

Multiplying the 9 starter dishes by the 15 main dishes by the 8 dessert dishes expresses the number of different ways of choosing a starter dish, a main dish and a dessert dish

Multiplying the 15 main dishes by the 8 dessert dishes expresses the number of different ways of choosing a main dish and a dessert dish

Multiplying the 9 starter dishes by the 15 main dishes expresses the number of different ways of choosing a starter dish and a main dish

Using the product rule for counting

(Total for Question 11 is 3 marks)

12 (a) Write $\frac{4x^2 - 9}{6x + 9} \times \frac{2x}{x^2 - 3x}$ in the form $\frac{ax + b}{cx + d}$ where a, b, c and d are integers.

$\frac{(2x + 3)(2x - 3)}{3(2x + 3)} \times \frac{2x}{x(x - 3)}$

Fully factorising the numerators and denominators of each fraction. Using difference of two squares for the $4x^2 - 9$. $A^2 - B^2 = (A + B)(A - B)$

$\frac{2x - 3}{3} \times \frac{2}{x - 3}$

Dividing both the numerators and denominators by 2x + 3 and by x

Multiplying the fractions by multiplying the numerators and multiplying the denominators

$\frac{4x - 6}{3x - 9}$

(3)

(b) Express $\frac{3}{x + 1} + \frac{1}{x - 2} - \frac{4}{x}$ as a single fraction in its simplest form.

$\frac{3x(x - 2)}{x(x + 1)(x - 2)} + \frac{x(x + 1)}{x(x + 1)(x - 2)} - \frac{4(x + 1)(x - 2)}{x(x + 1)(x - 2)}$

The denominators must be the same to add and subtract fractions. Multiplying the denominators together expresses a common denominator. Multiplying the numerators by whatever their denominator was multiplied by

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

Expanding the 4(x + 1) on the numerator of the 3rd fraction to get 4x + 4 and writing multiplied by the x - 2

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

Expanding all the brackets on the numerators and combining the numerators of all three fractions

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

The brackets are not needed for the first two brackets. Flipping the signs of all terms in the 3rd bracket as it is negative

Collecting like terms for the combined numerator. Now putting back into the fraction. The denominator stays the same when the fractions are added. The brackets do not need to be expanded for the denominator as factorised form is just as simple as expanded form. There are no common factors between the numerator and denominator so it cannot go any simpler

$\frac{-x + 8}{x(x + 1)(x - 2)}$

(3)

(Total for Question 12 is 6 marks)

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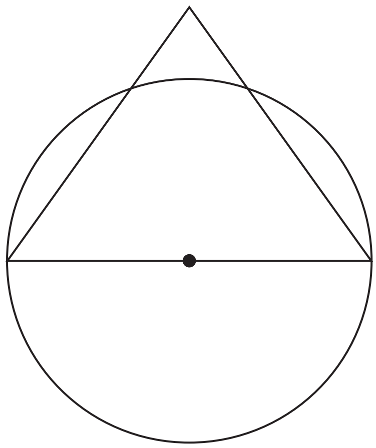
13 The diagram shows a circle and an equilateral triangle.

One side of the equilateral triangle is a diameter of the circle.
The circle has a circumference of 44 cm.

Work out the area of the triangle.
Give your answer correct to 3 significant figures.



$180 \div 3 = 60$

There are 180° in total in a triangle and all three angles are equal in an equilateral triangle. So dividing 180° by 3 works out that each angle in the triangle is 60°

$\pi d = 44$

Circumference = π × diameter. Then dividing both sides by π finds that the diameter is 44/π cm, which is also the side length of the equilateral triangle (which are all the same)

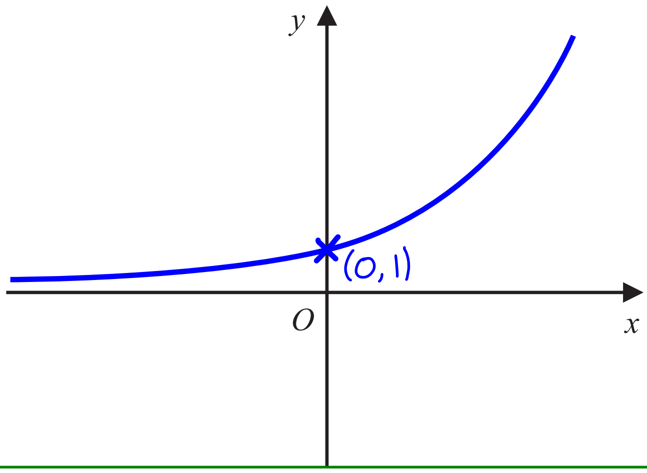
$\frac{1}{2} \times \frac{44}{\pi} \times \frac{44}{\pi} \times \sin 60$

Area of triangle = 1/2 absinC, where a and b are two sides and C is the angle between them

84.9 cm^2

(Total for Question 13 is 3 marks)

14 On the grid, sketch the curve with equation $y = 2^x$
Give the coordinates of any points of intersection with the axes.



Using table mode on the calculator. Define f(x) = 2^x. Start: -5. End: 5. Step: 1. This gives a table of values which can be used to visualise the shape of the graph and any intersections which the axes

(Total for Question 14 is 2 marks)

15 The equation of a circle is $x^2 + y^2 = 42.25$

Find the radius of the circle.

$\sqrt{42.25}$ ← The general equation of a circle with its centre at the origin is $x^2 + y^2 = \text{radius}^2$. So $\text{radius}^2 = 42.25$ then square rooting finds the radius

6.5

(Total for Question 15 is 1 mark)

16 There are only red counters and blue counters in a bag.

Joe takes at random a counter from the bag.
The probability that the counter is red is 0.65
Joe puts the counter back into the bag.

Mary takes at random a counter from the bag.
She puts the counter back into the bag.

(a) What is the probability that Joe and Mary take counters of different colours?

$1 - 0.65$ ← It is certain to either get red or blue. So subtracting the probability of red from 1 finds that the probability of blue is 0.35

$0.65 \times 0.35 + 0.35 \times 0.65$ ← Red AND blue OR blue AND red. AND means to multiply the probabilities. OR means to add the probabilities

0.455

(2)

There are 78 red counters in the bag.

(b) How many blue counters are there in the bag?

$\frac{0.35}{0.65} \times 78$ ← Expressing the probability of blue as a fraction of the probability of red. Doing this fraction of the 78 red counters

42

(2)

(Total for Question 16 is 4 marks)

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17 p and q are two numbers such that $p > q$

When you subtract 5 from p and subtract 5 from q the answers are in the ratio 5 : 1
When you add 20 to p and add 20 to q the answers are in the ratio 5 : 2

Find the ratio $p : q$
Give your answer in its simplest form.

$p - 5 = 5(q - 5)$ — Subtracting 5 from p gives p - 5. Subtracting 5 from q gives q - 5. To make these equal, the q - 5 must be multiplied by 5

$= 5q - 25$ — Expanding the brackets on the right

$p = 5q - 20$ — Adding 5 to both sides to get p on its own. This forms the 1st equation

$2(p + 20) = 5(q + 20)$ — Adding 20 to p gives p + 20. Adding 20 to q gives q + 20. To make these equal, the p + 20 can be multiplied by 2 and the q + 20 can be multiplied by 5

$2p + 40 = 5q + 100$ — Expanding the brackets

$2p = 5q + 60$ — Subtracting 40 from both sides. This forms the 2nd equation

$p = 80$ — Doing simultaneous equations with the 1st and 2nd equations. The two equations have the same number of q. Subtracting the 1st equation from the 2nd equation cancels out the q terms

$80 = 5q - 20$ — Substituting the value of p into the 1st equation

$100 = 5q$ — Adding 20 to both sides to get the q term on its own

$20 = q$ — Dividing both sides by 5 to get q on its own

$80 : 20$ — Expressing the ratio of p : q

Ratios simplify in a similar way to fractions. Putting the fraction 80/20 into the calculator simplifies it to 4, which is 4/1 as a fraction. So the ratio must simplify to 4 : 1

4 : 1

(Total for Question 17 is 5 marks)

18 The straight line $\mathbf{L}_1$ passes through the points with coordinates (4, 6) and (12, 2)
The straight line $\mathbf{L}_2$ passes through the origin and has gradient −3

The lines $\mathbf{L}_1$ and $\mathbf{L}_2$ intersect at point P.

Find the coordinates of P.

$\frac{2 - 6}{12 - 4}$ ← Gradient = (change in y)/(change in x). y changes from 6 to 2 so the change in y is 2 - 6. x changes from 4 to 12 so the change in x is 12 - 4. The gradient is -0.5

$6 = -0.5(4) + c$ ← The general equation of a straight line is y = mx + c, where m is the gradient and c is the y-intercept. Substituting the coordinates (4, 6) into the equation and substituting -0.5 for m

$8 = c$ ← Adding 0.5(4) to both sides gets c on its own

$y = -0.5x + 8$ ← Substituting the values of m and c into y = mx + c gives the equation of L_1

$y = -3x$ ← This is the equation of L_2. m is -3 as this is the gradient. c is 0 as this is the y-intercept

$-3x = -0.5x + 8$ ← Both -0.5x + 8 and -3x are equal to y so they must be equal to each other

$-2.5x = 8$ ← Adding 0.5x to both sides to get all the x on the same side

$x = -3.2$ ← Dividing both sides by -2.5 gets x on its own

$y = -3(-3.2)$ ← Substituting the value of x into y = -3x to find y

x-coordinate y-coordinate

(-3.2 , 9.6)

(Total for Question 18 is 4 marks)

19 Solve $22 < \dfrac{m^2 + 7}{4} < 32$

Show all your working.

$88 < m^2 + 7 < 128$ ← Multiplying all sides by 4 to eliminate the denominator

$81 < m^2 < 121$ ← Subtracting 7 from all sides to get the m^2 on its own

Doing the positive and negative square root the 81 and 121 to eliminate the square and get m on its own. The inequality symbols must flip for the negative solutions

$9 < m < 11$
$-9 > m > -11$

(Total for Question 19 is 5 marks)

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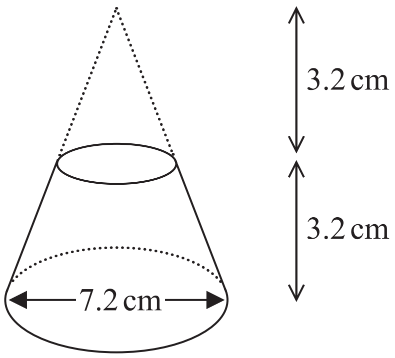
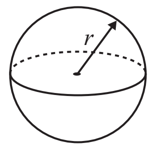
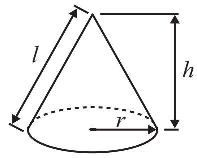
20 Here is a frustum of a cone.



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



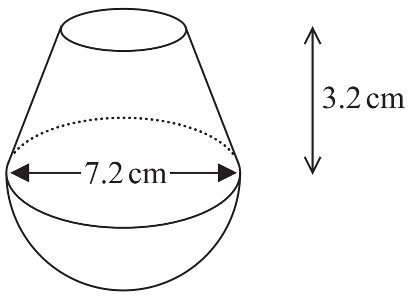
Volume of cone $= \frac{1}{3}\pi r^2 h$



The diagram shows that the frustum is made by removing a cone with height 3.2 cm from a solid cone with height 6.4 cm and base diameter 7.2 cm.

The frustum is joined to a solid hemisphere of diameter 7.2 cm to form the solid **S** shown below.

Solid **S**



The density of the frustum is 2.4 g/cm^3
The density of the hemisphere is 4.8 g/cm^3

Calculate the average density of solid **S**.

$d\ {}^{m}\ v$ — Writing a formula triangle for density, mass, volume

$7.2 \div 2 = 3.6$ — The radius is half of the diameter, so is 3.6 cm

$\frac{1}{2} \times \frac{4}{3} \times \pi \times 3.6^3 = 97.7\ldots$ A — Doing 1/2 of the volume of the sphere to get the volume of the hemisphere. Substituting 3.6 cm for the radius. Storing the exact value as A on the calculator

$4.8 \times 97.7\ldots = 469.0\ldots$ B — Covering m in the formula triangle finds that mass = density × volume. So the mass of the hemisphere is 469.0... g. Storing the exact value as B on the calculator

$\frac{1}{3} \times \pi \times 3.6^2 \times 6.4 = 86.8\ldots$ C — Substituting 3.6 cm for the radius in the formula for the volume of a cone works out that the cone with height 6.4 cm has a volume of 86.8... cm^3. Storing the exact value as C on the calculator

$3.6 \div 2$ — The height of 3.2 cm is half of the height of 6.4 cm. So as the two cones are similar, dividing the radius of the larger cone by 2 works out that the radius of the smaller cone is 1.8 cm

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$\frac{1}{3} \times \pi \times 1.8^2 \times 3.2 = 10.8...$ D

Substituting 1.8 cm for the radius in the formula for the volume of a cone works out that the cone with height 3.4 cm has a volume of 10.8.. cm^3. Storing the exact value as D on the calculator

$86.8... - 10.8... = 76.0...$ E

Subtracting the volume of the smaller cone (stored as D) from the volume of the larger cone (stored as C) works out that the volume of the frustum is 76.0... cm^3. Storing the exact value as E on the calculator

$2.4 \times 76.0...$

Covering m in the formula triangle finds that mass = density × volume. So the mass of the frustum is 182.4... g. Using the exact value which was stored as E for the volume of the frustum

$469.0... + 182.4... = 651.4...$ F

Adding the mass of the hemisphere (stored as B) and the exact value of the mass of the frustum works out that the total mass of solid S is 651.4... g. Storing the exact value as F on the calculator

$97.7... + 76.0...$

Adding the volume of the hemisphere (stored as A) and the volume of the frustum (stored as E) works out that the volume of solid S is 173.7... cm^3

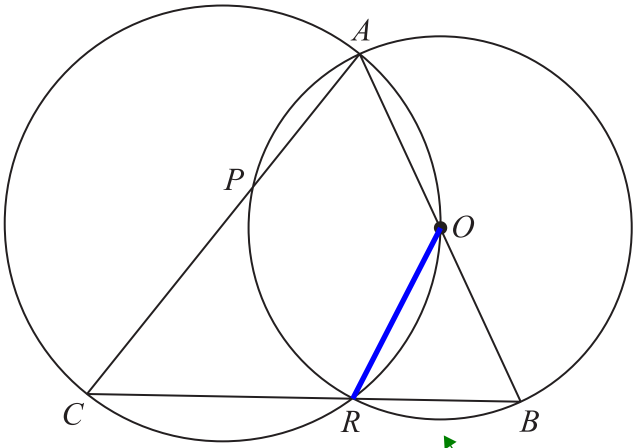
$651.4... \div 173.7...$

Covering d in the formula triangle finds that density = mass ÷ volume. Using the exact value of the mass of solid S (stored as F) and the exact value of the volume of solid S

3.75 g/cm^3

(Total for Question 20 is 5 marks)

21



A, *B*, *R* and *P* are four points on a circle with centre *O*.
A, *O*, *R* and *C* are four points on a different circle.
The two circles intersect at the points *A* and *R*.

CPA, *CRB* and *AOB* are straight lines.

Prove that angle *CAB* = angle *ABC*.

Let angle CAB = x

Angle CRO = 180 - x as opposite angles in a cyclic quadrilateral add to 180°

Angle CRO is opposite to angle CAB in the cyclic quadrilateral. So subtracting angle CAB from 180° leaves angle CRO

Angle ORB = x as angles around a point on a straight line add up to 180°

Angles CRO and ORB are around the same point on a straight line. Adding x to 180 - x gives 180 so angle ORB must be x

Triangle ORB is isosceles as sides OR and OB are both radii so they are equal

Isosceles triangles have two equal sides

Angle ABC = x as the base angles of an isosceles triangle are equal

Angles ORB and ABC are the base angles of the isosceles triangle

So angle CAB = angle ABC ← As they are both equal to x

(Total for Question 21 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS