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 ▶

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.

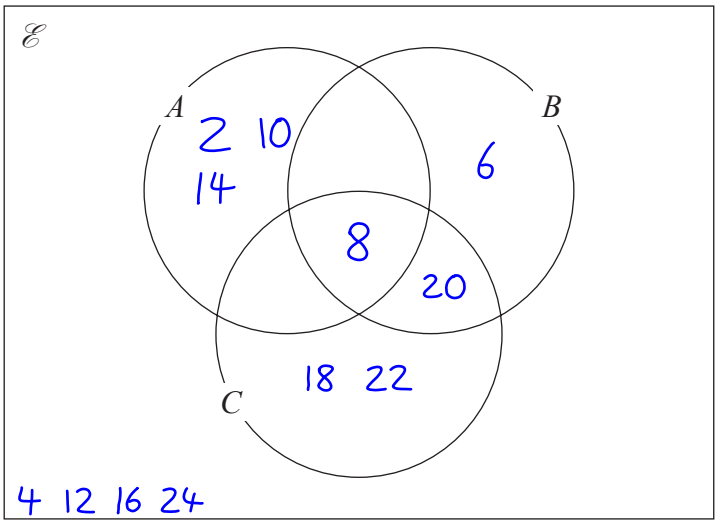
Write your answers in the spaces provided.

You must write down all the stages in your working.

1 $\mathscr{E}$ = {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 $A \cap B$.

1 out of the 12 numbers is in A and B

$\frac{1}{12}$

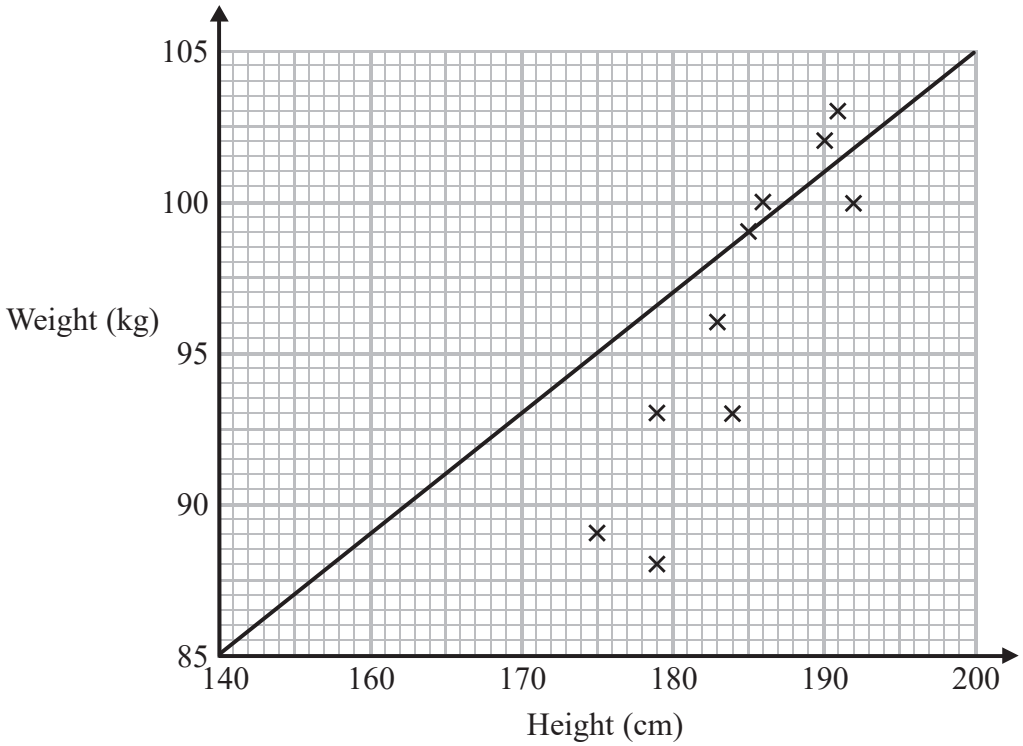
(2)

(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.

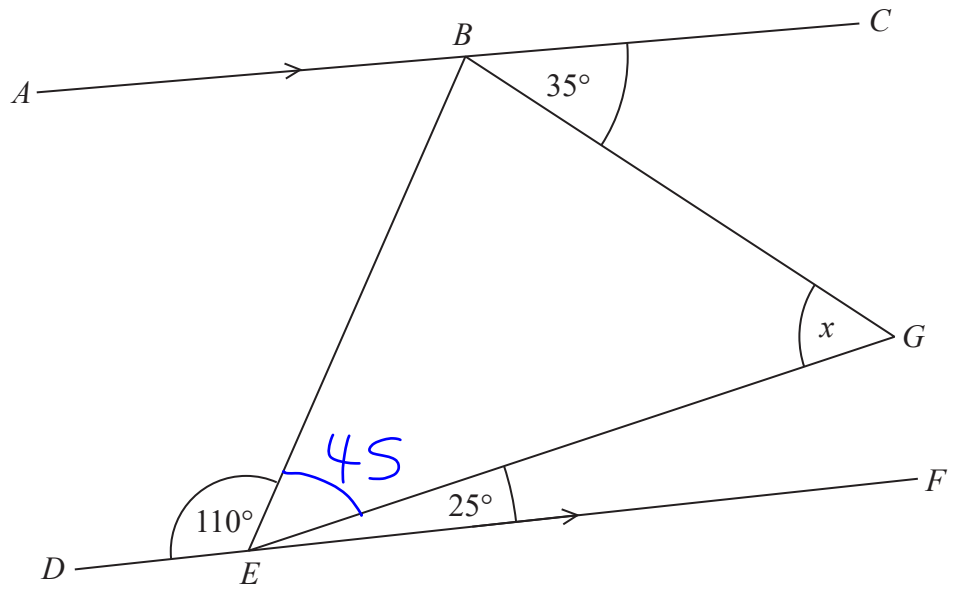
Write down two things that are wrong with his answer.

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 x axis

(Total for Question 2 is 2 marks)

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 = 45
Angle BEG is 45° as angles on a straight line add to 180°

Angle EBC is 110° as it is an alternate angle to DEB

110 - 35 = 75
Angle EBG is 75°

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

60 °

(Total for Question 3 is 4 marks)

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.

100% + 2.5% = 102.5%
102.5/100 = 1.025

$2000 \times 1.025^3 = £2153.78$ ← This calculates the amount of money Ali will have in 3 years

$2153.78 - 2000 = £153.78$ ← Subtracting the original amount works out how much interest Ali gets

100% + 3.5% = 103.5%
103.5/100 = 1.035

$1600 \times 1.035^3 = £1773.95$ ← This calculates the amount of money Ben will have in 3 years

$1773.95 - 1600 = £173.95$ ← Subtracting the original amount works out how much interest Ben gets

Ben ← Ben got more interest than Ali

(4)

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

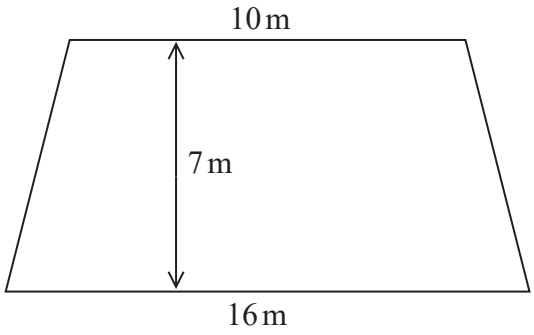
(b) Does this affect who will get the most interest by the end of 3 years?
Give a reason for your answer.

No as Ben will get even more interest

(1)

(Total for Question 4 is 5 marks)

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



£16.99

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.

$\frac{1}{2}(10+16)\times 7 = 91$ ← 1/2 x (a + b) x h = area of trapezium. This works out the area of the floor

$91 \div 2 = 45.5$ ← This works out how many litres of paint are needed

$45.5 \div 5 = 9.1$ ← This works out how many tins of paint are needed

$10 \times £16.99 = £169.90$ ← This works out the cost of the paint needed

The number of tins is rounded up to 10 as there needs to be a whole number of tins and 9 isn't enough

No ← £169.90 is more than the £160 he has to spend

(Total for Question 5 is 5 marks)

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.

$\frac{15-9}{d-5} = 3$ ← Change in y over change in x works out the gradient

$15-9 = 3d-15$ ← Rearranging to find d

$21 = 3d$

7

(Total for Question 6 is 3 marks)

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

Multiply by ten 5 times to get a number between 1 and 10 so multiply by 10^{-5} to make up for this

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 gives 7441979.07.
Pressing ENG converts it to 7.44197907×10^{6}

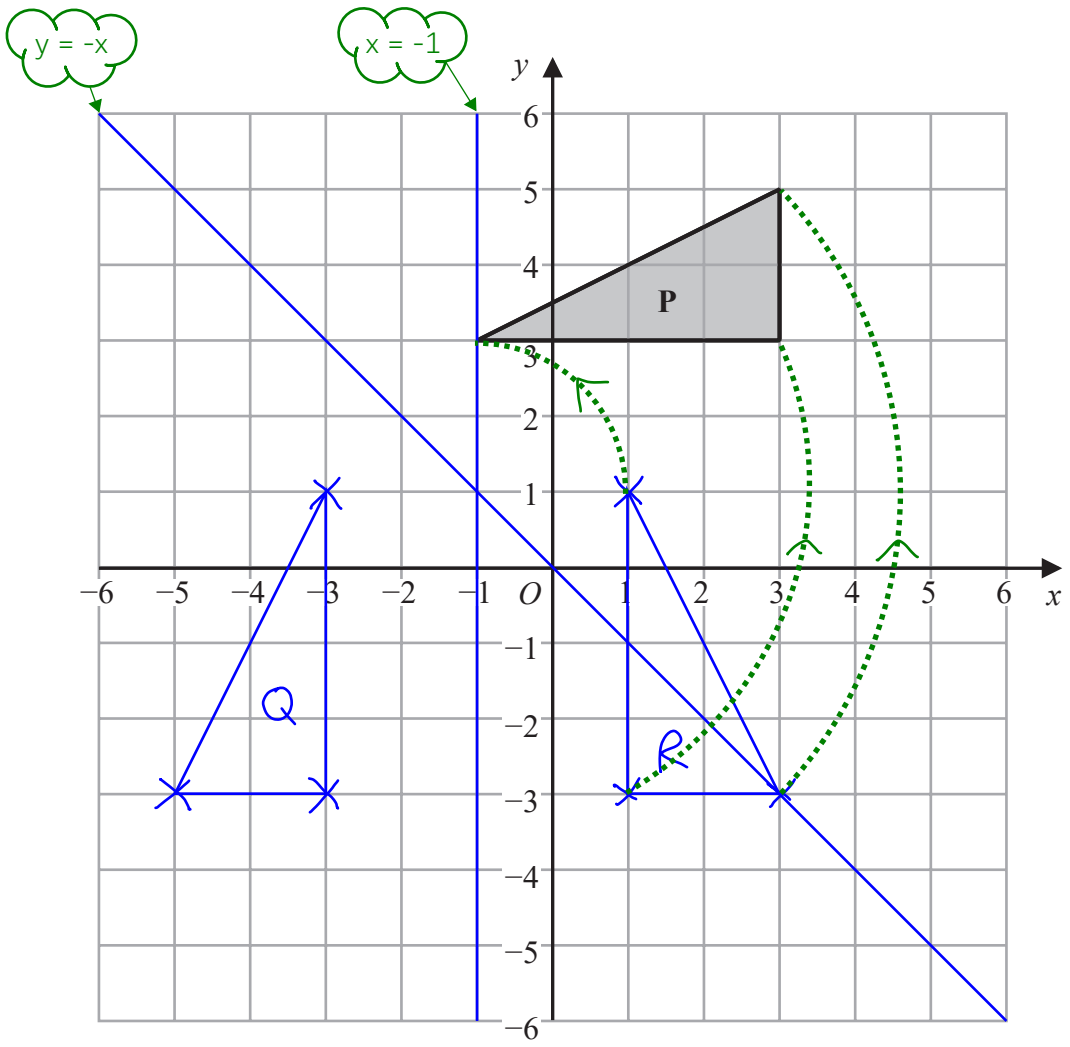
3 significant figures means writing only the first 3 figures and everything else is ignored after rounding the 3rd figure

7.44×10^{6}

(2)

(Total for Question 7 is 3 marks)

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 around (-1 , 1)

(Total for Question 8 is 3 marks)

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

$7 \leq N < 8$

(Total for Question 9 is 2 marks)

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.

$5p = 50 \quad p = 10$ ← There are 5 parts in total and these are equal to 50 litres. Dividing by 5 works out what 1 part is worth

$Y = 20 \quad B = 30$ ← 10 x 2 = 20 so there are 20 litres of yellow paint. 10 x 3 = 30 so there are 30 litres of blue paint

$\frac{20}{5} = 4 \quad \frac{30}{10} = 3$ ← 4 tins of yellow paint and 3 tins of blue paint are needed

$4 \times £26 = £104$ ← 4 tins of yellow paint cost £104

$3 \times £48 = £144$ ← 3 tins of blue paint cost £144

$£104 + £144 = £248$ ← £248 is his total costs of creating the green paint

$\frac{50}{10} \times £66.96 = £334.80$ ← 50/10 works out the number of green tins he sells. Multiplying this by the cost he sells them for works out his income

$\frac{£334.80 - £248}{£248} \times 100$ ← Using the formula for percentage change

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.

Using the product rule for counting

$9 \times 15 + 15 \times 8 + 9 \times 15 \times 8 = 1335$

a starter dish and a main dish

a main dish and a dessert dish

a starter dish, a main dish and a dessert dish

(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.

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

Fully factorise the numerators and denominators and multiply the fractions together. Use the difference of two squares to factorise $4x^2 - 9$

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

Cancel out the factors common to the numerator and denominator

Expand the remaining brackets to get the form we are looking for

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

(3)

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

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

Make a common denominator by multiplying the denominators together. The numerator needs to be multiplied by whatever the denominator is multiplied by

$\frac{3x^2 - 6x + x^2 + x - 4x^2 + 8x - 4x + 8}{x(x+1)(x-2)}$

Expand the brackets on the numerators and combine the numerators as the denominators are the same

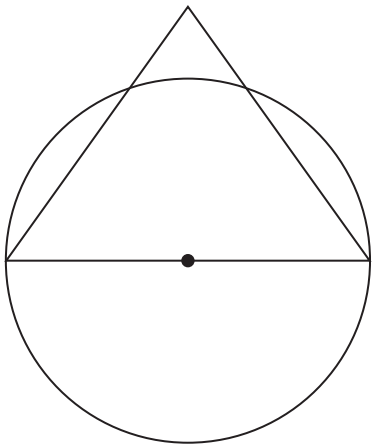
Collect like terms and simplify the numerator. As there are no factors common to the numerator and denominator, this cannot be simplified further

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

(3)

(Total for Question 12 is 6 marks)

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.

π x diameter = circumference of a circle.
Rearranging to find the diameter, which is the same length as the sides of the triangle

$\pi d = 44 \quad d = \frac{44}{\pi}$

$\frac{1}{2}\left(\frac{44}{\pi}\right)^2 \times \sin 60$ = 84.93882397

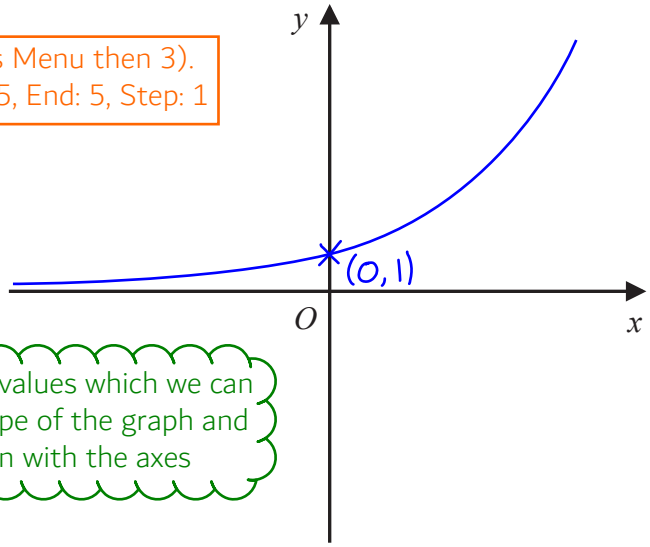
1/2 x a x b x sinC = area of a triangle

84.9 cm²

(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.

Use table mode (press Menu then 3).
Put in f(x) = 2^x. Start: -5, End: 5, Step: 1



This gives us a table of values which we can use to visualise the shape of the graph and see any intersection with 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 is $x^2 + y^2 = r^2$ so $r^2 = 42.25$

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?

$0.65 \times 0.35 + 0.35 \times 0.65$

Probability of red and then blue

Or

Probability of blue and then red

1 - 0.65 = 0.35 so this is the probability of getting a blue

Joe puts the counter back into the bag so the probability is unchanged for when Mary picks

0.455

(2)

There are 78 red counters in the bag.

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

$x \times 0.65 = 78$

$x = \frac{78}{0.65} = 120$

$120 - 78$

x is the total number of 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.

$p - 5 = 5(q - 5)$ ← p - 5 is 5 times greater than q - 5 so multiplying q - 5 by 5 makes them equal

$p = 5q - 20$ ← Expanding the bracket and making p the subject to make the equation simpler

$2(p + 20) = 5(q + 20)$ ← The ratio between p + 20 and q + 20 is 5:2 so multiplying p + 20 by 2 and q + 20 by 5 makes them equal

$2(5q - 20 + 20) = 5(q + 20)$ ← Substituting p for 5q - 20

$10q = 5q + 100$ ← -20 and +20 cancel out. Then expand the brackets

$5q = 100$ ← Subtract 5q from both sides to get all the q terms on the same side

$q = 20$ ← Divide both sides by 5 to solve q

$p = 5(20) - 20 = 80$ ← Substitute q for 20 in the equation p = 5q - 20

$80 : 20$ ← Ratio p:q

Divide both sides of the ratio by 20 to simplify → $4 : 1$

(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.

$\frac{2-6}{12-4} = -\frac{1}{2}$ ← Finding the gradient of L_1. Change in y/change in x

$y = -\frac{1}{2}x + c$ ← The general equation of a straight line is y = mx + c, where m is the gradient and c is the y-intercept

$c = 6 + \frac{1}{2}(4) = 8$ ← Rearranging to find c and substituting the x and y values of (4 , 6), which lies on the line

$y = -\frac{1}{2}x + 8$ ← The equation of L_1

$y = -3x$ ← The equation of L_2 as it has a gradient of -3 and has a y-intercept of 0 (it passes through the origin, (0 , 0)). The values have been substituted into y = mx + c

$-3x = -\frac{1}{2}x + 8$ ← Both of the right sides of the equations are equal to y so they must be equal to each other

$-\frac{5}{2}x = 8$, $x = \frac{-16}{5}$ ← Rearranging to find x

$y = -3\left(\frac{-16}{5}\right) = \frac{48}{5}$ ← Substituting -16/5 for x in y = -3x

($\frac{-16}{5}$, $\frac{48}{5}$)

(Total for Question 18 is 4 marks)

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

Show all your working.

Follow BIDMAS backwards to decide what to eliminate first to get m on its own

Eliminate the division first. The addition isn't done first as it is inside the division. Multiply all three sides of by 4

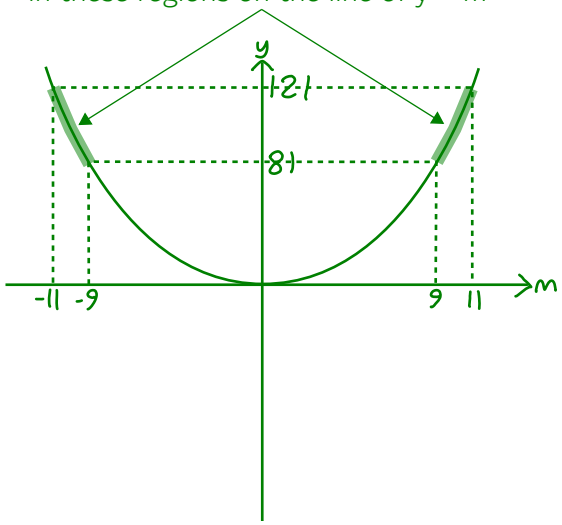
$88 < m^2 + 7 < 128$

Subtract 7 from all sides

$81 < m^2 < 121$

Square root all sides. The signs need to be flipped for the negative solutions

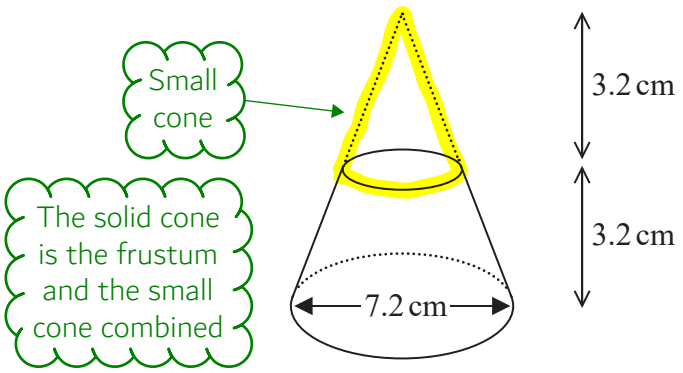
m^2 is greater than 81 and less than 121 in these regions on the line of $y = m^2$



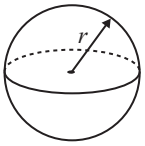
$9 < m < 11$, $-9 > m > -11$

(Total for Question 19 is 5 marks)

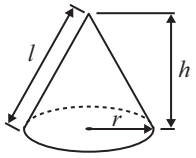
20 Here is a frustum of a cone.



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



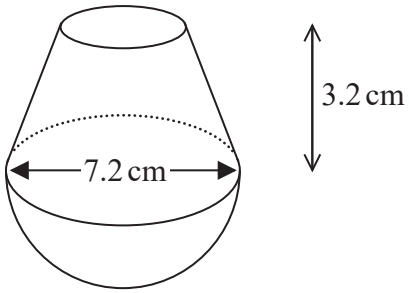
Volume of cone $= \frac{1}{3}\pi r^2 h$



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.

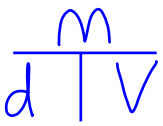
The frustum is joined to a solid hemisphere of diameter 7.2 cm to form the solid **S** shown below.

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**.



From the formula triangle,
density = mass/volume
mass = density x volume

Store the full answer of 76.00140948 on the calculator

$V_f = \frac{1}{3}\pi \times 3.6^2 \times 6.4 - \frac{1}{3}\pi \times 1.8^2 \times 3.2 = 76.0\ldots$

Volume of the frustum

Volume of the solid cone

Volume of the small cone

Looking at the cone from the side, it appears as a triangle. As the scale factor between the small cone and the solid cone is 2, the radius of the small cone is half of the solid cone

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$M_f = 2.4 \times V_f = 182.4\ldots$

Store the full answer of 182.4033827 on the calculator

Mass of the frustum

Density of the frustum

Volume of the frustum

Store the full answer of 97.7160979 on the calculator

$V_h = \frac{1}{2} \times \frac{4}{3}\pi \times 3.6^3 = 97.7\ldots$

Working out the volume of the hemisphere

$M_h = 4.8 \times V_h = 469.0\ldots$

Store the full answer of 469.0372699 on the calculator

Mass of the hemisphere

Density of the hemisphere

Volume of the hemisphere

$d = \frac{M_f + M_h}{V_f + V_h}$

Average density = total mass/total volume

3.75 g/cm^3

(Total for Question 20 is 5 marks)

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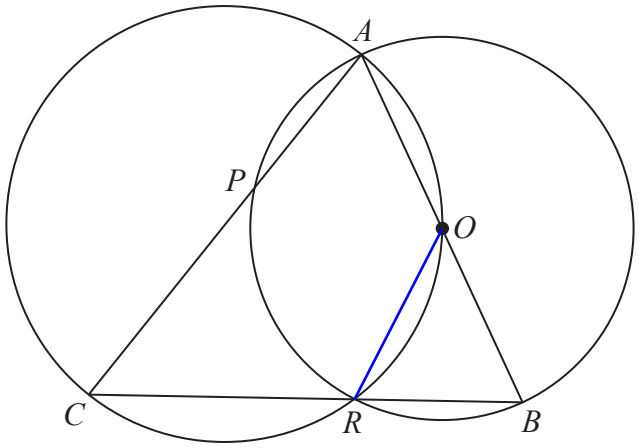
21



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.

AORC is a cyclic quadrilateral

Let angle CAB = x

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

Angle ORB = x as angles on a straight line add up to 180 degrees

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

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

Therefore angle CAB = angle ABC

(Total for Question 21 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS