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 5 November 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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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

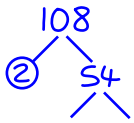
.CG Maths.

Answer ALL questions.

Write your answers in the spaces provided.

You must write down all the stages in your working.

1 Find the Lowest Common Multiple (LCM) of 108 and 120



Do factor trees for both 108 and 120 to express them as product of prime factors in index form. The Lowest Common Multiple is the highest power of each prime multiplied together

.....

(Total for Question 1 is 3 marks)

2 There are 60 people in a choir.
Half of the people in the choir are women.

The number of women in the choir is 3 times the number of men in the choir.
The rest of the people in the choir are children.

the number of children in the choir : the number of men in the choir = n : 1

Work out the value of n.
You must show how you get your answer.

30 ← Half of 60 is 30 so there are 30 women

Work out how many men there are using the fact the number of women in the choir is 3 times the number of men in the choir. Then work out the number of children using the fact the rest of the people in the choir are children. Write the ratio of men to children in the form M : C, where M is the number of men and C is the number of children. Simplify the ratio into the desired form to get 1 on the right by dividing both sides by the same amount in order to get the 1

n = ...

(Total for Question 2 is 4 marks)

3 Work out $1\frac{3}{4} \times 1\frac{1}{3}$

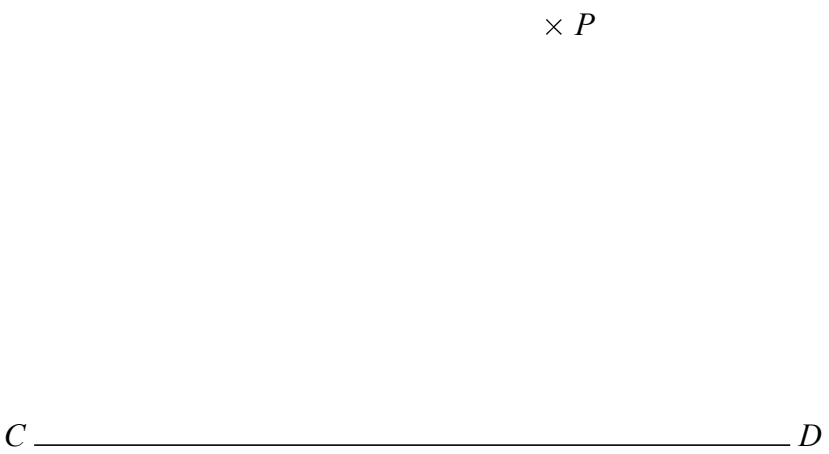
Give your answer as a mixed number.

Convert the mixed numbers into improper fractions by multiplying the whole numbers by the denominators then adding the results to the numerators. This makes it easier to multiply. Multiply the improper fractions by multiplying the numerators and denominators. Convert the result into a mixed number by dividing the numerator by the denominator to get the whole number and leave the remainder in the fraction

.....

(Total for Question 3 is 3 marks)

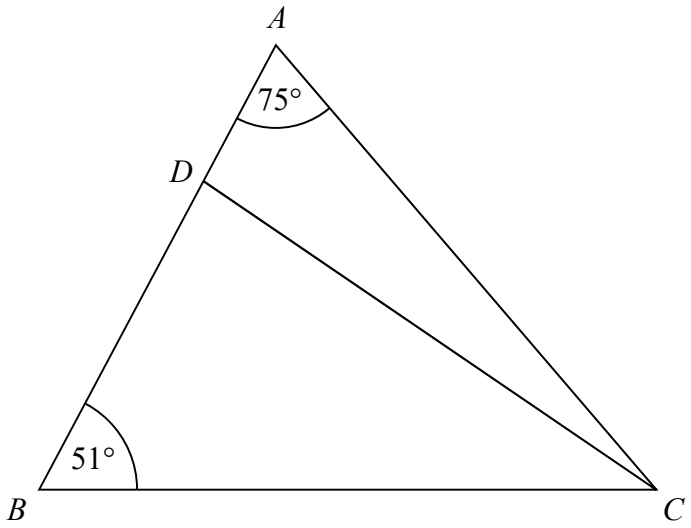
4 Use a ruler and compasses to construct the line from the point P perpendicular to the line CD.
You must show **all** construction lines.



1) Using a compass, scribe two arcs from point P on the line CD.
2) Using a compass, scribe arcs from both of the first arcs which meet below the line.
3) Draw a straight line using a ruler from point P through the cross

(Total for Question 4 is 2 marks)

5 The diagram shows triangle *ABC*.



ADB is a straight line.

the size of angle *DCB* : the size of angle *ACD* = 2 : 1

Work out the size of angle *BDC*.

Angles in a triangle add up to 180°. Use this fact to work out the angle ACB. This is the total of angles DCB and ACD so it can be divided into the ratio to find angle DCB. There are then two angles in triangle DBC so the missing angle, BDC, can be worked out

.....°

(Total for Question 5 is 4 marks)

6 4 red bricks have a mean weight of 5 kg.
5 blue bricks have a mean weight of 9 kg.
1 green brick has a weight of 6 kg.

Donna says,

"The mean weight of the 10 bricks is less than 7 kg."

Is Donna correct?
You must show how you get your answer.

Mean = total/number, where total is the total weight and number is the number of bricks. Writing this as a formula triangle

Using the formula triangle work out the total weight of the red bricks and the total weight of the blue bricks. Then add all of the totals together to work out the total weight of all 10 bricks. Use the formula triangle to work out the mean. If this is less than 7kg Donna is correct

(Total for Question 6 is 3 marks)

7 (a) Simplify $(p^2)^5$

$(a^x)^y = a^{xy}$

.....

(1)

(b) Simplify $12x^7y^3 \div 6x^3y$

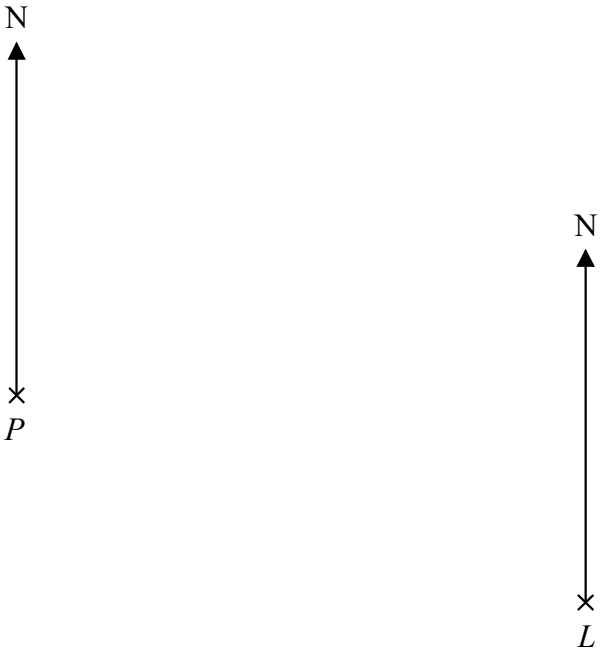
Divide the 12 by the 6, the x^7 by the x^3 and the y^3 by the y. Write all the results multiplied together. $a^x/a^y = a^{x-y}$

.....

(2)

(Total for Question 7 is 3 marks)

8 The accurate scale drawing shows the positions of port P and a lighthouse L.



Scale: 1 cm represents 4 km.

Aleena sails her boat from port P on a bearing of 070°

She sails for $1\frac{1}{2}$ hours at an average speed of 12 km/h to a port Q.

Find

(i) the distance, in km, of port Q from lighthouse L,

(ii) the bearing of port Q from lighthouse L.

s d t ← Writing the formula triangle for distance, speed and time

Work out the distance she sailed to port Q in kilometres. Use the scale to work out how many centimetres represent this. Measure 70° clockwise from north at P and draw a line of the length worked out in that direction. Port Q must be at the end of this line. Draw a straight line from the port Q to the lighthouse L. Measure its length using a ruler and use the scale to work out the actual distance in kilometres. Measure the anticlockwise angle from north at L and the line drawn. Subtract this angle from 360 to work out the bearing

distance QL = ... km

bearing of Q from L = ... °

(Total for Question 8 is 5 marks)

9 A car travels for 18 minutes at an average speed of 72 km/h.

(a) How far will the car travel in these 18 minutes?

s d t ← Writing the formula triangle for distance, speed, time

As the speed is given in terms of km/h, the time needs to be in hours to calculate the distance. Write the 18 minutes as a fraction of an hour using the fact there are 60 minutes in an hour then simplify the fraction

..... km

(2)

David says,

"72 kilometres per hour is faster than 20 metres per second."

(b) Is David correct?
You must show how you get your answer.

Convert the kilometres per hour into metres per hour using the fact there are 1000 metres in a kilometre. Convert the metres per hour into metres per minute using the fact there are 60 minutes in an hour. Convert the metres per minute into metres per second using the fact there are 60 seconds in a minute. If the result it greater than 20 David is correct

(2)

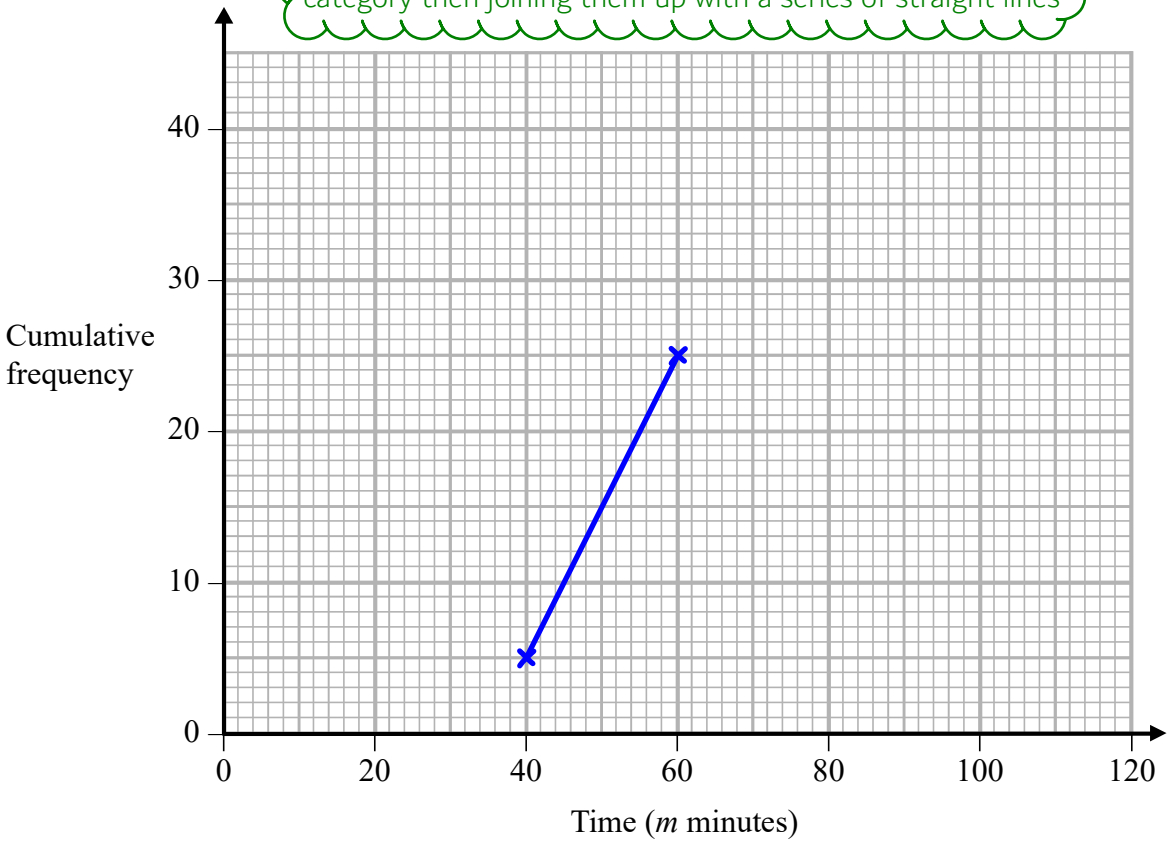
(Total for Question 9 is 4 marks)

10 The cumulative frequency table shows information about the times, in minutes, taken by 40 people to complete a puzzle.

Time (m minutes)	Cumulative frequency
$20 < m \leqslant 40$	5
$20 < m \leqslant 60$	25
$20 < m \leqslant 80$	35
$20 < m \leqslant 100$	38
$20 < m \leqslant 120$	40

(a) On the grid below, draw a cumulative frequency graph for this information.

Plotting the cumulative frequencies at the end of each category then joining them up with a series of straight lines



(2)

(b) Use your graph to find an estimate for the interquartile range.

Interquartile range = upper quartile - lower quartile. The lower quartile is roughly 1/4 of the way through the data and 1/4 of 40 is 10 so reading across from 10 on the cumulative frequency to the line then down works out the lower quartile. The upper quartile is roughly 3/4 of the way through the data

..... minutes

(2)

One of the 40 people is chosen at random.

(c) Use your graph to find an estimate for the probability that this person took between 50 minutes and 90 minutes to complete the puzzle.

Reading up from 50 to the line then across estimates how many people took 50 minutes or less. Reading up from 90 to the line then across estimates how many people took 90 minutes or less. Work out an estimate of how many people took 50 minutes or longer and 90 minutes or less. Express this many people as a fraction of the 40 people

.....

(2)

(Total for Question 10 is 6 marks)

11 There are p counters in a bag.
12 of the counters are yellow.

Shafiq takes at random 30 counters from the bag.
5 of these 30 counters are yellow.

Work out an estimate for the value of p.

We can estimate that 5/30 of the counters are yellow. This fraction of p is estimated to be 12. Create an equation using this then solve to find p

.....

(Total for Question 11 is 2 marks)

12 $T = \frac{q}{2} + 5$

Here is Spencer's method to make q the subject of the formula.

$2 \times T = q + 5$ ← There is a mistake here

$q = 2T - 5$

What mistake did Spencer make in the first line of his method?

He has multiplied by 2 to eliminate the fraction

.....

.....

.....

(Total for Question 12 is 1 mark)

13 (a) Write $\frac{5}{x+1} + \frac{2}{3x}$ as a single fraction in its simplest form.

Make a common denominator by multiplying the denominators together. The numerators need to be multiplied by the same as what its denominator was multiplied by. Expand any brackets on the numerators then the fractions can be added together. Collect like terms to simplify the numerator. Any brackets on the denominator shouldn't need to be expanded as this will not make it any simpler

.....

(2)

(b) Factorise $(x + y)^2 + 3(x + y)$

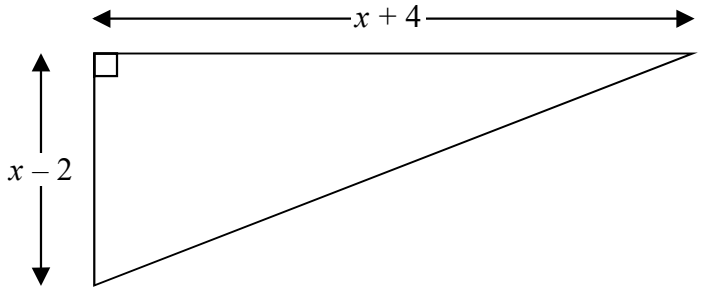
There are two terms in the expression. Find a common factor to both terms and bring this out as a common factor while leaving the rest in a bracket

.....

(1)

(Total for Question 13 is 3 marks)

14 The diagram shows a right-angled triangle.



All the measurements are in centimetres.

The area of the triangle is 27.5 cm^2

Work out the length of the shortest side of the triangle.
You must show all your working.

Area of triangle = 1/2 x base x height. Express the area in terms of x and set this equal to the actual area of 27.5. Eliminate the 1/2 by multiplying both sides by 2, expand the brackets, bring into the quadratic form $ax^2 + bx + c = 0$ then solve using factorisation. There will be two values of x but only one of these will work as the other will give negative lengths and length must be positive. Substitute the value of x into x - 2 to find the shortest side

..... cm

(Total for Question 14 is 4 marks)

15 Express $0.4\dot{1}\dot{8}$ as a fraction.
You must show all your working.

$x = 0.4\dot{1}\dot{8}$ ← Let x be the recurring decimal

Multiply by 10 twice as there are two recurring digits. Write the recurring digits in the same decimal place as in x. Subtracting the two decimals should cancel out the recurring digits. Rearrange to make x the subject. A fraction with decimals in it cannot be given as the final answer

.....

(Total for Question 15 is 3 marks)

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16 (a) Rationalise the denominator of $\dfrac{22}{\sqrt{11}}$

Give your answer in its simplest form.

Multiplying the numerator and denominator by $\sqrt{11}$ rationalises the denominator

.....

(2)

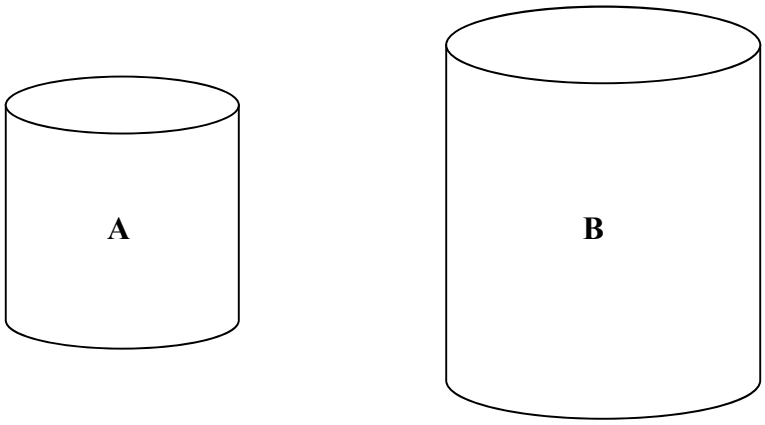
(b) Show that $\dfrac{\sqrt{3}}{2\sqrt{3}-1}$ can be written in the form $\dfrac{a+\sqrt{3}}{b}$ where a and b are integers.

Flipping the sign to a plus on the denominator and multiplying the numerator and denominator by this rationalises the denominator

(3)

(Total for Question 16 is 5 marks)

17 **A** and **B** are two similar cylindrical containers.



the surface area of container **A** : the surface area of container **B** = 4 : 9

Tyler fills container **A** with water.
She then pours all the water into container **B**.
Tyler repeats this and stops when container **B** is full of water.

Work out the number of times that Tyler fills container **A** with water.
You must show all your working.

Square rooting both sides of the ratio of the areas gives the ratio of the lengths. Cubing both sides of the ratio of the lengths gives the ratio of the volumes. Work out how many times the number of parts representing the volume of container A goes into the number of parts representing the volume of container B. Container A must be filled a whole number of times

.....

(Total for Question 17 is 4 marks)

18 The function f is given by

$$f(x) = 2x^3 - 4$$

(a) Show that $f^{-1}(50) = 3$

Find the inverse function by switching f(x) with x and x with y then rearrange to find y. Substitute 50 for x in the inverse function. The result should be 3

(2)

The functions g and h are given by

$$g(x) = x + 2 \quad \text{and} \quad h(x) = x^2$$

(b) Find the values of x for which

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

Substituting g(x) for x in h(x) works out the composite function hg(x). Expand out the square bracket using square the first term, double the product of the two terms, square the last term. Set this equal to the $3x^2 + x - 1$. Bring into the quadratic form $ax^2 + bx + c = 0$ so it can be solved using factorisation

.....

(4)

(Total for Question 18 is 6 marks)

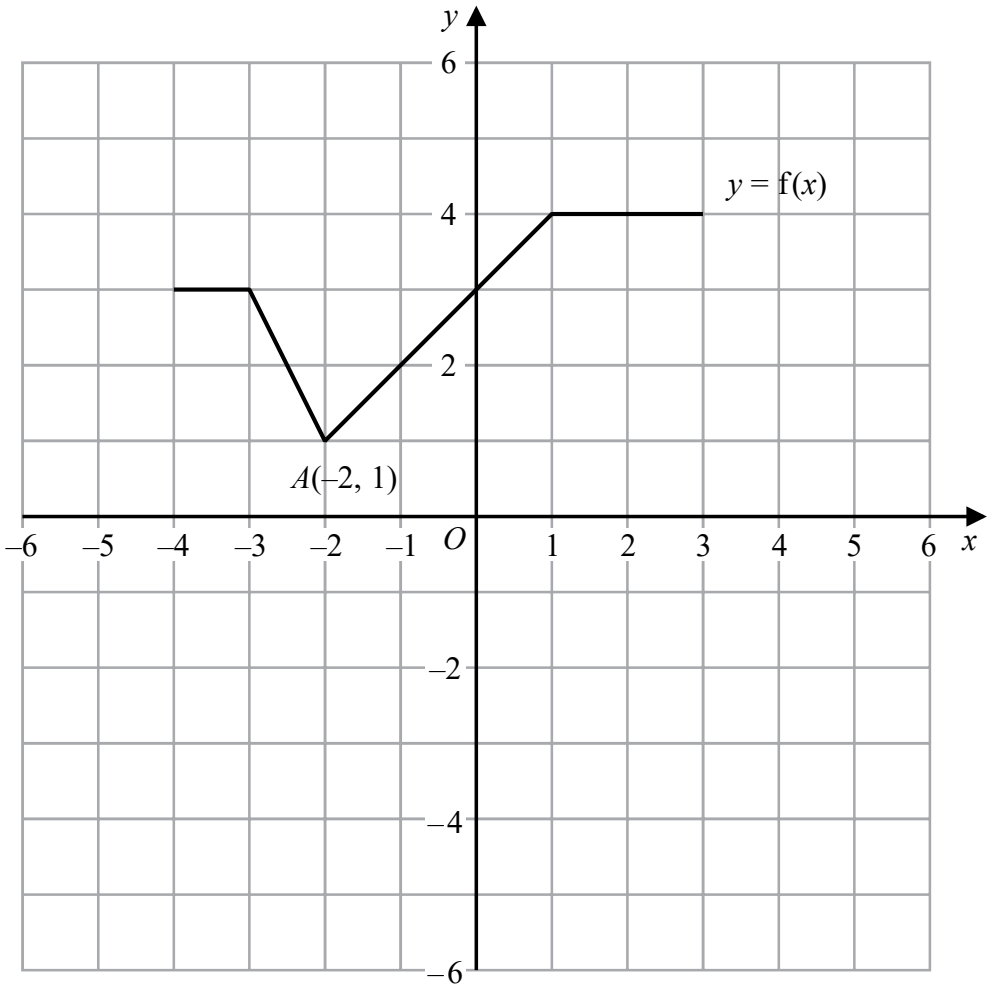
19 Given that $9^{-\frac{1}{2}} = 27^{\frac{1}{4}} \div 3^{x+1}$
find the exact value of x.

Express 9 and 27 as powers of 3 so that they are all powers of 3. $9 = 3^2$. $(a^x)^y = a^{xy}$. $a^x/a^y = a^{x-y}$. Once expressed as a power of 3 on the left and a power of 3 on the right, the power on the left must be equal to the power on the right. This creates an equation in terms of x which can be rearranged to solve

$x =$ .....

(Total for Question 19 is 3 marks)

20 The graph of $y = f(x)$ is shown on the grid.



(a) On the grid, draw the graph with equation $y = f(x + 1) - 3$

(2)

It moves 1 to the left and 3 down

Point $A(-2, 1)$ lies on the graph of $y = f(x)$.

When the graph of $y = f(x)$ is transformed to the graph with equation $y = f(-x)$, point A is mapped to point B.

(b) Write down the coordinates of point B.

All the x coordinates are multiplied by -1. It reflects in the y axis

(..... , ...)

(1)

(Total for Question 20 is 3 marks)

21 Sketch the graph of

$$y = 2x^2 - 8x - 5$$

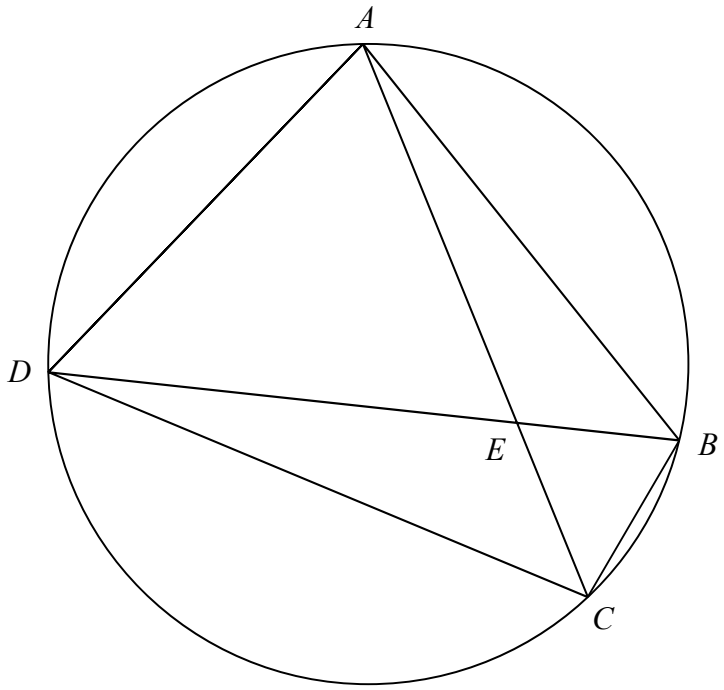
showing the coordinates of the turning point and the exact coordinates of any intercepts with the coordinate axes.

Bring out 2 as a factor for the first two terms so that it is in a form where it is possible to complete the square then complete the square. This can work out the turning point as the minimum a squared bracket can be is 0. Work out what x must be for this to be the case then work out what y is when the square bracket is 0. The x-intercepts can be found by setting the completed the square form equal to 0 then rearranging to find x. The y-intercept can be found by substituting x for 0 in the original equation.

Completing the square: $y = ax^2 + bx + c = a(x + b/2a)^2 + c - a(b/2a)^2$

(Total for Question 21 is 5 marks)

22 A, B, C and D are four points on a circle.



AEC and DEB are straight lines.

Triangle AED is an equilateral triangle.

Prove that triangle ABC is congruent to triangle DCB.

A side is shared by both triangles. Angles in an equilateral triangle are equal. Angles in the same segment from the same chord are equal. The proof ASA can be used

(Total for Question 22 is 4 marks)

TOTAL FOR PAPER IS 80 MARKS