Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
MATHEMATICS

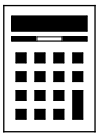
F

Foundation Tier Paper 3 Calculator

Tuesday 11 June 2019 Morning Time allowed: 1 hour 30 minutes

Materials

For this paper you must have:
- a calculator
- mathematical instruments.



Instructions

- Use black ink or black ball-point pen. Draw diagrams in pencil.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 80.
- You may ask for more answer paper, graph paper and tracing paper. These must be tagged securely to this answer book.

Advice

In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Pages	Mark
2–3	
4–5	
6–7	
8–9	
10–11	
12–13	
14–15	
16–17	
18–19	
20–21	
22–23	
24–25	
26	
TOTAL	

Please note that these worked solutions have neither been provided nor approved by AQA 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 in the spaces provided

Do not write outside the box

1 Circle the value of the digit 2 in the answer to 5200 ÷ 10

[1 mark]

5200 ÷ 10 = 520

2 | 20 | 200 | 2000

The 2 is in the tens place so is worth 20

2 Solve $x - 8 = 5$

Circle your answer.

[1 mark]

$x = -13$ | $x = -3$ | $x = 3$ | $x = 13$

To solve, the equation needs to be rearranged to get x on its own.
Adding 8 to both sides gets rid of the -8 on the left side. 5 + 8 = 13

3 Circle the fraction that is equal to $2\frac{1}{4}$

[1 mark]

$\frac{7}{4}$ | $\frac{9}{4}$ | $\frac{21}{4}$ | $\frac{25}{4}$

Type into the calculator. It will convert it into an improper fraction in its simplest form

Do not write outside the box

4 Circle the expression which means x divided by y

[1 mark]

$\frac{x}{y}$ $\frac{y}{x}$ $\frac{1}{xy}$ $\frac{1}{x+y}$

Division can be written as a fraction. What we are dividing by becomes the denominator

5 Put these numbers in order from smallest to largest.

$\frac{31}{40}$ $\frac{3}{4}$ $\frac{7}{10}$ 0.725

[2 marks]

0.775 0.75 0.7

Type into the calculator and press the SD button to convert into a decimal

Smallest $\frac{7}{10}$

0.725

$\frac{3}{4}$

Largest $\frac{31}{40}$

All the numbers have 0 units and 7 tenths. 0.7 has 0 hundredths so is the smallest. 0.725 has 2 hundredths so is the next smallest. 0.75 has 5 hundredths so is the next smallest

6

Do not write outside the box

6 Josh downloads album A.

A has 11 tracks.

Each track on A costs the same.

The total cost of downloading A is £8.80

Josh also downloads album B.

B has 14 tracks.

6 (a) Work out the total cost of downloading B.

Assume each track costs the same as a track on A.

[3 marks]

$\frac{8.80}{11} \times 14$

Dividing the £8.80 by the 11 tracks on A works out the cost of each track. Multiplying by 14 as there are this many tracks on B and we are assuming each track costs the same

Answer £ 11.20

Do not write outside the box

6 (b) In fact, compared to the cost of each track on A

the cost of 6 tracks on B is **more** by 5p each

the cost of 8 tracks on B is **less** by 5p each.

What does this tell you about your answer to part (a)?

Tick **one** box.

- [✓] The total cost is **less** than my answer to part (a)
- [ ] The total cost is **more** than my answer to part (a)
- [ ] The total cost is **the same** as my answer to part (a)

Give a reason for your decision. 6 x 5 - 8 x 5 = -10

[2 marks]

Overall it will be 10p cheaper

Turn over for the next question

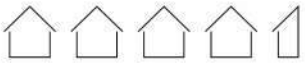
5

Do not write outside the box

7 The pictogram shows information about the houses in a street.

Each house has 3, 4 or 5 bedrooms.

Key:  represents 2 houses

3-bedroom houses	
4-bedroom houses	
5-bedroom houses	

In total, how many bedrooms do these houses have?

[3 marks]

$4.5 \times 2 \times 3 + 5 \times 2 \times 4 + 1.5 \times 2 \times 5$

There are 4.5 pictures for the 3-bedroom houses and each one represents 2 houses. Multiplying 4.5 by 2 works out how many houses have 3 bedrooms. Multiplying this by 3 works out how many bedrooms these houses have

There are 1.5 pictures for the 5-bedroom houses and each one represents 2 houses. Multiplying 1.5 by 2 works out how many houses have 5 bedrooms. Multiplying this by 5 works out how many bedrooms these houses have

There are 5 pictures for the 4-bedroom houses and each one represents 2 houses. Multiplying 5 by 2 works out how many houses have 4 bedrooms. Multiplying this by 4 works out how many bedrooms these houses have

Answer 82

Do not write outside the box

8 Four positive whole numbers add up to 84

One of the numbers is a multiple of 17

The other three numbers are equal.

What are the four numbers?

[3 marks]

$\frac{84-17}{3} = \frac{67}{3}$

$\frac{84-17\times2}{3} = \frac{50}{3}$

$\frac{84-17\times3}{3} = 11$

17 is the first multiple of 17. 17 x 2 works out the second and 17 x 3 works out the third. Subtracting each of these from 84 works out how much would be left over for the other three numbers. Dividing this by 3 works out what the three other numbers would be. As they have to be whole numbers, they must be 11 (67/3 and 50/3 aren't whole numbers). 17 x 3 = 51

Answer 51 11 11 11

Turn over for the next question

6

Do not write outside the box

9 Jim wants to buy 10 rolls of wallpaper.

He sees these prices.

Wallpaper	
Single roll	£12.50
Pack of 3 rolls	£34.50
Pack of 5 rolls	£58.75

What is the cheapest price for 10 rolls?

[4 marks]

$12.50 \times 10 = 125$ Working out the cost of 10 single rolls

$34.50 \times 3 + 12.50 = 116$ 3 lots of 3 can fit into 10 so the pack of 3 can be bought 3 times. 1 single roll needs to be bought to make it up to 10 rolls

$58.75 \times 2 = 117.50$ 2 lots of 5 can fit into 10 so the pack of 5 can be bought 2 times

Answer £ 116

Do not write outside the box

10 In rectangle *ABCD*

triangle *ABE* is equilateral

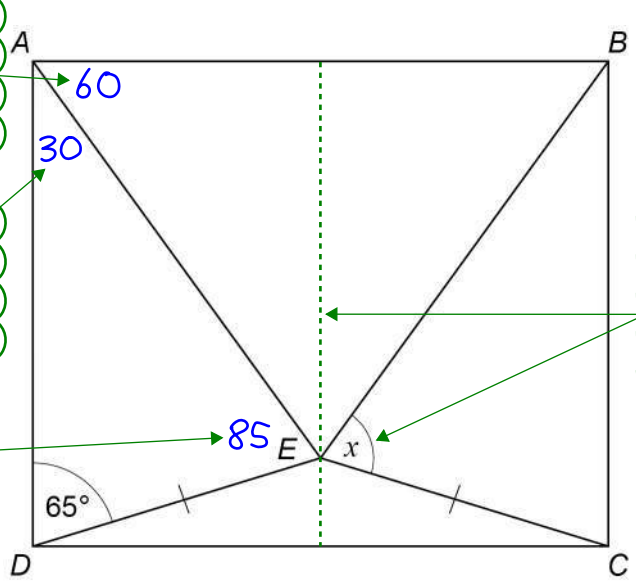
triangle *CDE* is isosceles, with *CE* = *DE*

1. There are 180 degrees in a triangle. As ABE is equilateral, all the angles are the same. 180/3 = 60

2. The angle in a rectangle is a right angle, so is 90 degrees in total. 90 - 60 = 30

3. There are 180 degrees in triangle ADE. 180 - 30 - 65 = 85

4. The whole shape is symmetrical as the rectangle, equilateral triangle and isosceles triangle all have a line of symmetry on this line. So x is the same as angle AED



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Work out the size of angle x.

[4 marks]

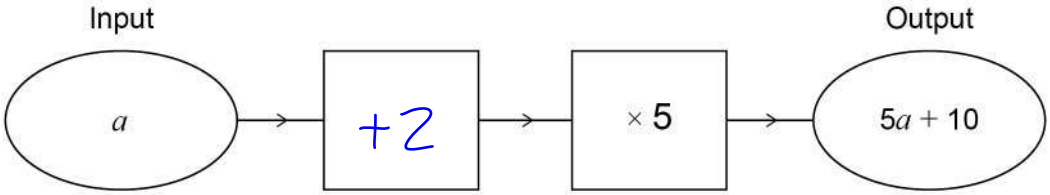
Answer 85 degrees

8

Turn over ►

Do not write outside the box

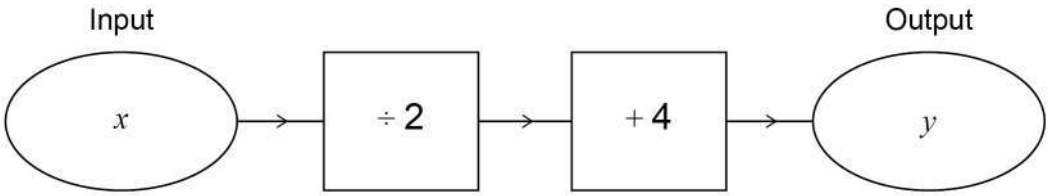
11 (a) Complete the number machine.



[1 mark]

Following the machine backwards: the opposite of multiplying by 5 is dividing by 5. (5a + 10)/5 = a + 2. So 2 has to be added to a

11 (b) Write down the output y in terms of x.



[1 mark]

Answer $\frac{x}{2} + 4$

Divide x by 2 then add 4

Do not write outside the box

12 The first four triangular numbers are 1, 3, 6, 10

Circle the next triangular number.

[1 mark]

14 (15) 16 19

Start with 1. Add 2, then add 3, then add 4, then add 5

13 Write down **all** the prime numbers between 40 and 50

[2 marks]

Answer 41, 43, 47

Even numbers above 2 are not prime as they can be divided by 2 so 42, 44, 46 and 48 aren't prime.

Numbers in the times tables aren't prime as they can be divided. 45 is in the 5 times table and 49 is in the 7 times table so these aren't prime.

This leaves 41, 43 and 47. As they are above the 3 times table, we need to check if they can be divided by 3. They can't so they must be prime

FACT B

0, ,,

Using the calculator to check if each number is prime: enter the number, press = then SHIFT then FACT. This expresses the number as a product of primes. If it comes back as itself, it must be prime as it can't be divided by any other primes

Turn over for the next question

5

Do not write outside the box

14 In this question use

1 cubic foot = 6.23 gallons

1 cubic foot = 0.028 cubic metres

Convert 3115 gallons into cubic metres.

[3 marks]

$\frac{3115}{6.23} \times 0.028$

There is a conversion between cubic feet and cubic metres so first the gallons need to be converted into cubic feet. Every 6.23 gallons is 1 cubic foot so dividing 3115 gallons by 6.23 works out how many lots of 6.23 it is and therefore works out how many cubic feet it is. Multiplying by 0.028 next converts it into cubic metres as every cubic foot is 0.028 cubic metres

Answer 14 m^3

Do not write outside the box

15 Circle the correct statement.

[1 mark]

$\frac{1}{3} \leqslant 30\%$ $\frac{1}{3} = 30\%$ $\frac{1}{3} < 30\%$ $\frac{1}{3} \neq 30\%$

1/3 x 100 = 33.3̇

This converts the fraction into a percentage. It isn't equal to 30

16 Which shape **must** have rotational symmetry?

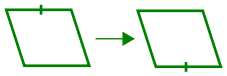
Circle your answer.

[1 mark]

isosceles triangle trapezium kite parallelogram

Rotational symmetry: can be rotated within 360 degrees and look the same

When it is rotated 180 degrees, it will look the same



Turn over for the next question

5

Do not write outside the box

17 A shop sells ice creams.

Each ice cream has two scoops.

The possible flavours are vanilla (V), strawberry (S), chocolate (C) and mint (M).

The two scoops can be the same flavour or different flavours.

17 (a) List **all** the possible options for the two scoops.

[2 marks]

VV SS CC MM
VS SC CM
VC SM
VM

The possibilities are systematically listed

Do not write outside the box

17 (b) In one hour the shop sells 180 scoops of ice cream.

The number of scoops of each flavour is shown in the table.

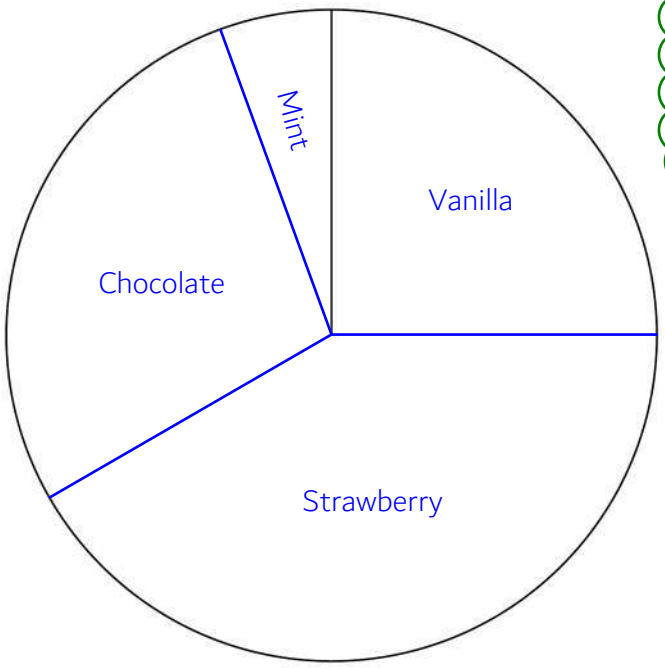
Flavour	Vanilla	Strawberry	Chocolate	Mint
Number of scoops	45	75	50	10

90 150 100 20

Complete the pie chart to represent the data.

[4 marks]

Multiplying each of the number of scoops by 2 as 2 degrees represents each scoop



Angles drawn using a protractor

$\frac{360}{180} = 2$

There are 360 degrees in total and this represents 180 scoops of ice cream. So dividing the 360 by 180 works out that 2 degrees represent each scoop

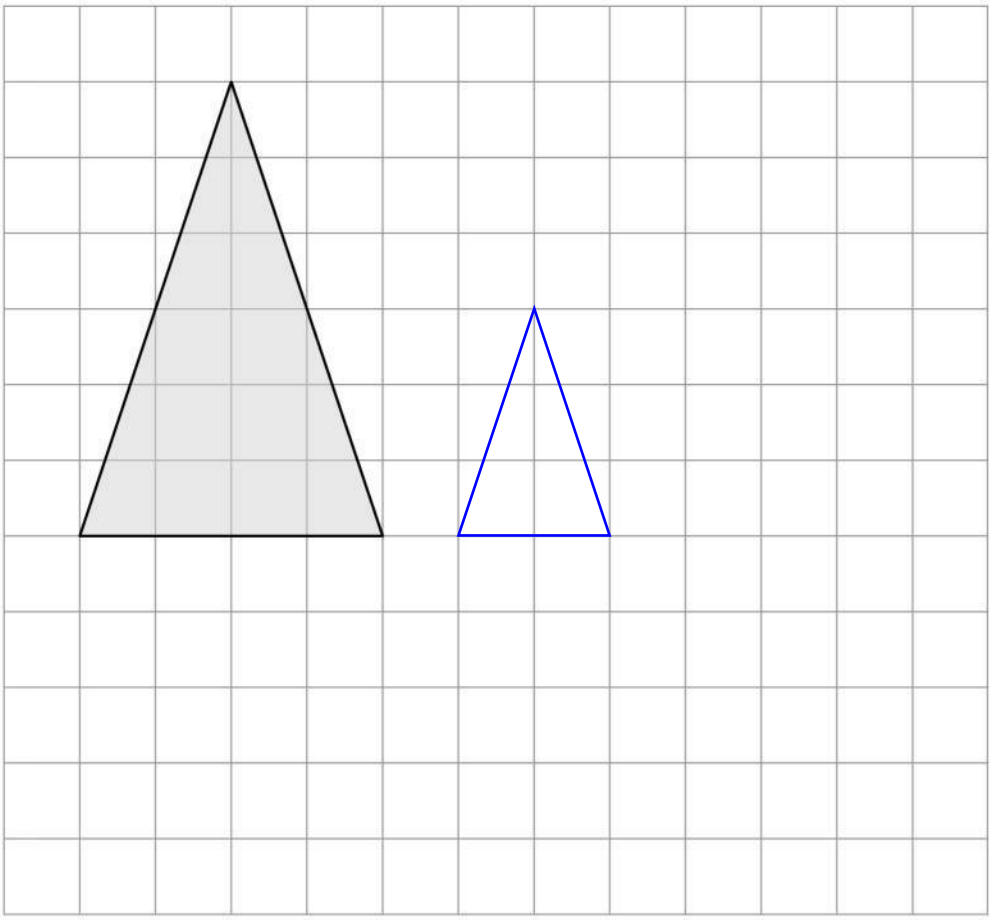
6

Turn over ►

Do not write outside the box

18 On the grid, draw an enlargement of the triangle with scale factor $\frac{1}{2}$

[2 marks]



The base had a length of 4. Multiplying this by 1/2 works out that the new base should have a length of 2.

The height was 6. Multiplying this by 1/2 works out that the new height should be 3

Do not write outside the box

19 (a) Simplify fully $3a^2 + 7a + 3 - a^2 + 8a - 4$

[3 marks]

Collecting the like terms.
$3a^2 - a^2 = 2a^2$
$7a + 8a = 15a$
$3 - 4 = -1$

Answer $2a^2 + 15a - 1$

19 (b) Factorise fully $24y^2 - 20y$

[2 marks]

4y is the highest common factor of both terms.
$24y^2/4y = 6y$
$-20y/4y = -5$

Answer $4y(6y - 5)$

20 Solve $x^2 = 196$

[2 marks]

$\sqrt{196} = 14$

Square rooting both sides gets rid of the square on x to get it on its own. However, the square root of a number can also be negative

Answer $x = 14, x = -14$

9

Do not write outside the box

21 To the nearest pound, Jon has £9

To the nearest 50p, Ellie has £6.50

Work out the maximum possible total amount of money.

[3 marks]

$(9+\frac{1}{2}-0.01)+(6.50+\frac{0.50}{2}-0.01)$

Jon: to work out the maximum amount he has, add half of the resolution (£1 in this case as it is to the nearest pound) to £9 to get the upper bound. However, this amount isn't possible as it would round to £10 so £0.01 needs to be taken away.

Ellie: to work out the maximum amount she has, add half of the resolution (£0.50 in this case as it is to the nearest 50p) to £6.50 to get the upper bound. However, this amount isn't possible as it would round to £7 so £0.01 needs to be taken away.

Add the maximum amount for Jon and Ellie to get the maximum possible total amount of money

Answer £ 16.23

Do not write outside the box

22 Here is a formula.

$$T = n^2 - \frac{12}{n}$$

22 (a) Work out T when $n = 5$

[1 mark]

$5^2 - 12/5$

Answer 22.6

22 (b) Why is T **always** positive when n is negative?

[2 marks]

n^2 will be positive. -12/n will be positive. Positive + positive = positive

As negative multiplied by negative is positive

As negative divided by negative is positive

6

Do not write outside the box

23 In one hour a machine can make

600 nuts

or

720 bolts.

At 3 pm the machine starts working.

It makes 900 nuts and then changes to making bolts.

How many **bolts** will the machine make by 8 pm?

[4 marks]

$(8-3-\frac{900}{600})\times 720$

8pm - 3pm works out the difference in time and therefore how many hours the machine works for. 900/600 works out how many lots of 600 are in 900 and therefore how many hours it takes to make the nuts as each lot of 600 takes an hour. Subtracting this from the number of hours the machine works for works out how many hours the machine has to make bolts. Multiplying this number of hours by 720 gives the number of bolts made

Answer 2520

Do not write outside the box

24 Two solids, J and K, have the same density.

Complete the table.

Include units in your answers.

[3 marks]

	J	K
Mass	48 g	78 g
Volume	8 cm^3	13 cm^3
Density	6 g/cm^3	6 g/cm^3

3. 78/6 = 13 The unit of volume will be the same as for J

1. 48/8 = 6 We have divided g by cm^3 so the unit will be g/cm^3

2. J and K have the same density

$d \; m \; V$

From the formula triangle:
Density = mass/volume
Volume = mass/density

Turn over for the next question

7

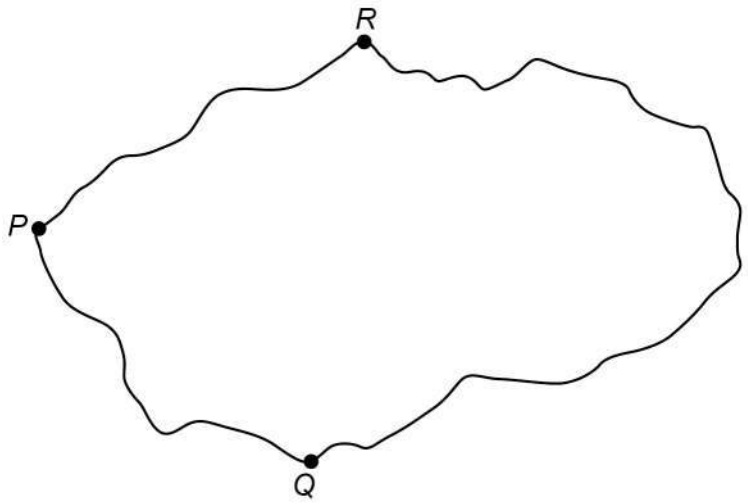
Do not write outside the box

25 Towns *P*, *Q* and *R* are connected by roads *PQ*, *PR* and *QR*.

PR is 10 km longer than *PQ*.

QR is twice as long as *PR*.

The total length of the three roads is 170 km



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Work out the length of *PQ*.

[4 marks]

$x + (x+10) + (2(x+10))$ ← Let x be PQ. PR is x + 10 and QR is 2(x + 10). Expressing the total length of the three roads

$x + x + 10 + 2x + 20$ ← Expanding the brackets and getting rid of the brackets which aren't needed

$4x + 30 = 170$ ← Collecting the like terms and simplifying. The expression of the total length must be equal to 170

$x = \frac{170-30}{4}$ ← Making x, PQ, the subject by subtracting 30 then dividing by 4

Answer 35 km

Do not write outside the box

26 Mia wants to borrow £6000 and repay it, with interest, after two years.

She sees two offers for loans.

Offer 1	**Offer 2**
Compound interest	Compound interest
3% per year	First year 1%
	Second year 5%

Mia says,

"I will pay back the same amount because the average of 1% and 5% is 3%"

Is she correct?

You **must** show your working.

[3 marks]

$6000 \times 1.03^2 = 6365.40$

100% + 3% = 103%, which is 1.03 as a decimal (divide by 100 to convert a percentage to a decimal). So multiplying £6000 by 1.03 twice (or 1.03^2) increases it by 3% twice

$6000 \times 1.01 \times 1.05 = 6363$

100% + 1% = 101%, which is 1.01 as a decimal. 100% + 5% = 105%, which is 1.05 as a decimal. So multiplying £6000 by 1.01 then by 1.05 increases it by 1% then 5%

NO

Offer 1 has a different amount to pay back than Offer 2

Turn over for the next question

7

Do not write outside the box

27 Here are two sets of numbers, A and B.

Set A

200	160
104	100

Set B

270	400	483
300	x	

mean of Set A : mean of Set B = 3 : 8

Work out the value of x.

[4 marks]

$\left(\frac{200+160+104+100}{4} \div 3\right) \times 8 \times 5 - 270 - 400 - 483 - 300$

Adding up all the numbers in Set A and dividing by 4 to work out the mean. 3 parts of the ratio represents the mean of Set A so dividing by 3 works out 1 part. Multiplying by 8 works out 8 parts, which represents the mean of Set B.

Mean = total/number, total = mean x number
So multiplying the mean of Set B by 5 (the number of numbers in Set B) works out the total of Set B. Subtracting the other numbers leaves x

Answer 427

Do not write outside the box

28 A straight line

has gradient 4

and

passes through the point (5, 23)

Work out the equation of the line.

Give your answer in the form $y = mx + c$

[3 marks]

$c = 23 - 4(5)$

Rearranging y = mx + c to get c = y - mx then substituting 23 for y, 5 for x and 4 for m (the gradient)

m is the gradient and c was found above

Answer $y = 4x + 3$

Turn over for the next question

7

Do not write outside the box

29 Two sides of a triangle have lengths 13 cm and 27 cm

Which of these is a **possible** length of the other side?
Circle your answer.

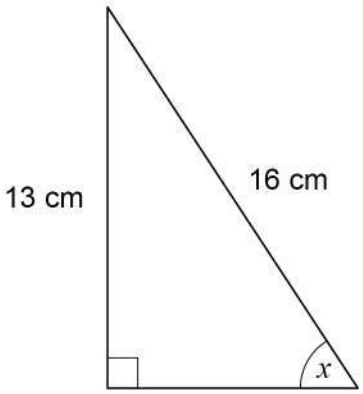
[1 mark]

13 cm 14 cm (27 cm) 40 cm

It can't be 13cm as the two sides of 13cm combined are shorter than the 27cm. It can't be 14cm as 13 + 14 = 27 so it wouldn't form a triangle. It can't be 40cm as 13 + 27 = 40 and they need to be longer than 40cm combined to make a triangle

30 Here is a right-angled triangle.

Not drawn accurately



Use trigonometry to work out the size of angle x.

[2 marks]

SOH CAH TOA

$x = \sin^{-1}\left(\frac{13}{16}\right)$

Listing SOH CAH TOA, ticking O (as we have the opposite) and H (as we have the hypotenuse). As there are two ticks on SOH, this formula can be used. From the formula triangle, sin(x) = opp/hyp. So x = $\sin^{-1}$(opp/hyp)

Answer 54.3 degrees

END OF QUESTIONS

3