

Surname <i>StemUp Model Solution</i>
First name(s)

Centre Number

Candidate Number
0



GCSE

3300U40-1



WEDNESDAY, 16 NOVEMBER 2022 – MORNING

MATHEMATICS
UNIT 2: CALCULATOR-ALLOWED
INTERMEDIATE TIER

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this examination.
A ruler, a protractor and a pair of compasses may be required.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen. Do not use gel pen or correction fluid.

You may use a pencil for graphs and diagrams only.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** the questions in the spaces provided.

If you run out of space, use the additional page at the back of the booklet. Question numbers must be given for all work written on the additional page.

Take π as 3.14 or use the π button on your calculator.

INFORMATION FOR CANDIDATES

You should give details of your method of solution when appropriate.

Unless stated, diagrams are not drawn to scale.

Scale drawing solutions will not be acceptable where you are asked to calculate.

The number of marks is given in brackets at the end of each question or part-question.

In question 3, the assessment will take into account the quality of your organisation, communication and accuracy in writing.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	3	
2.	2	
3.	6	
4.	9	
5.	3	
6.	2	
7.	2	
8.	4	
9.	4	
10.	5	
11.	4	
12.	4	
13.	7	
14.	8	
15.	3	
16.	3	
17.	2	
18.	5	
19.	4	
Total	80	

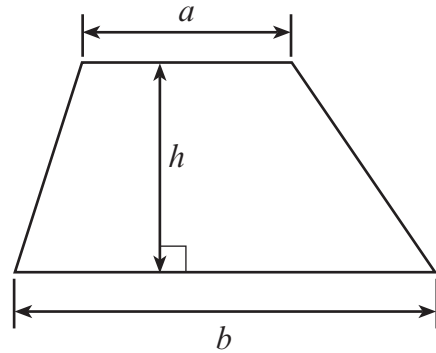
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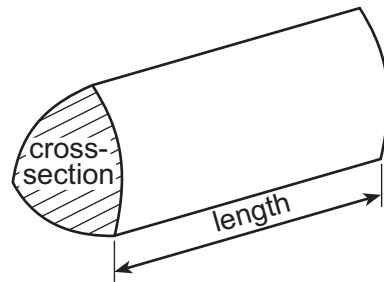
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Formula List – Intermediate Tier

Area of trapezium $= \frac{1}{2}(a + b)h$

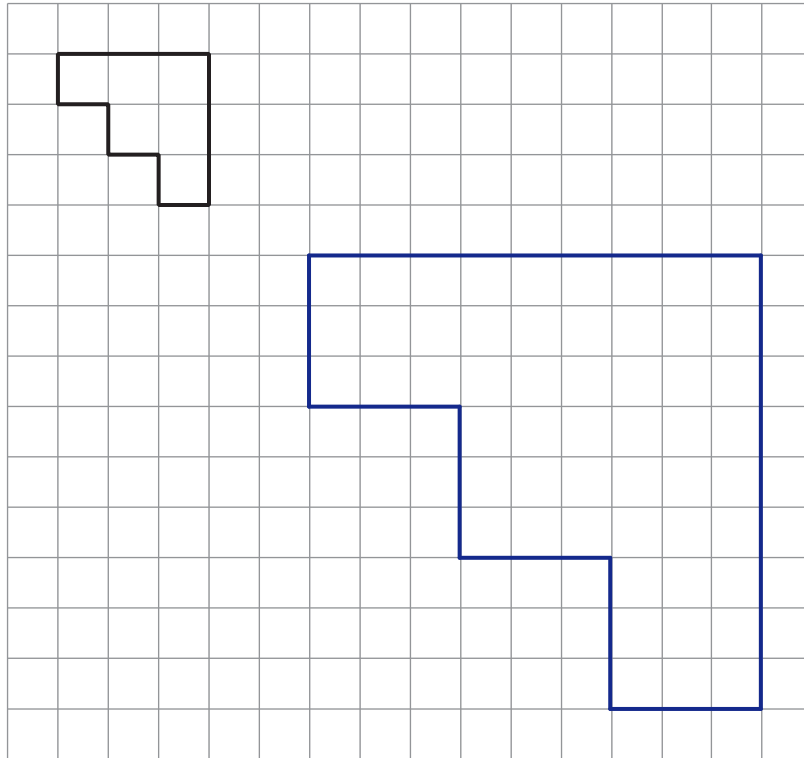


Volume of prism $= \text{area of cross-section} \times \text{length}$



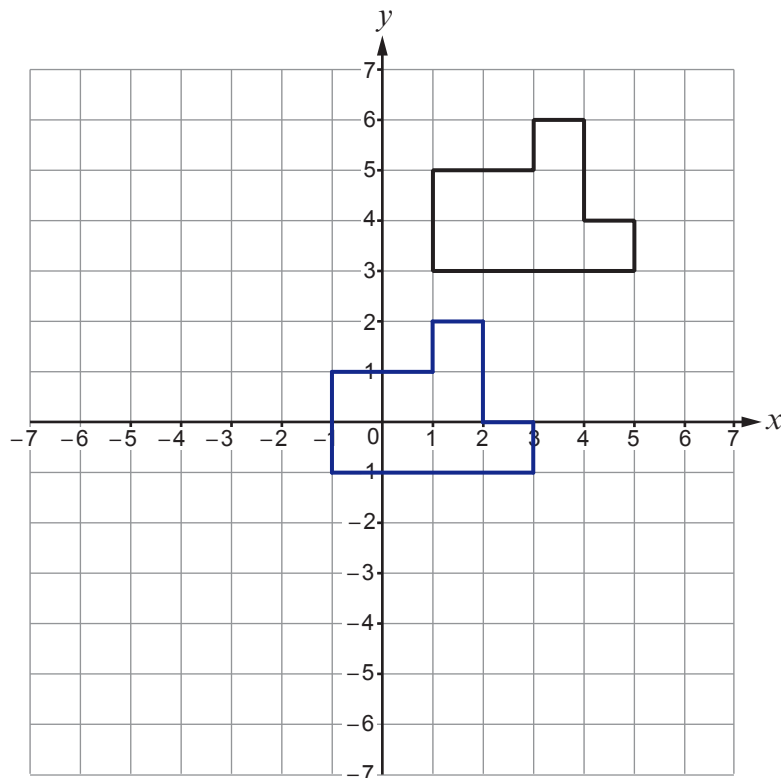
1. (a) Enlarge the shape below by a scale factor of 3.

[2]



- (b) Translate the shape below 2 squares to the left and 4 squares down.

[1]



2. Calculate the value of $7p + 6q$ when $p = -9.2$ and $q = 4.7$.

[2]

$$7p + 6q = 7 \times (-9.2) + 6 \times 4.7$$

$$= -64.4 + 28.2$$

$$= -36.2$$



3. In this question, you will be assessed on the quality of your organisation, communication and accuracy in writing.

In the diagram below, AF is a straight line.

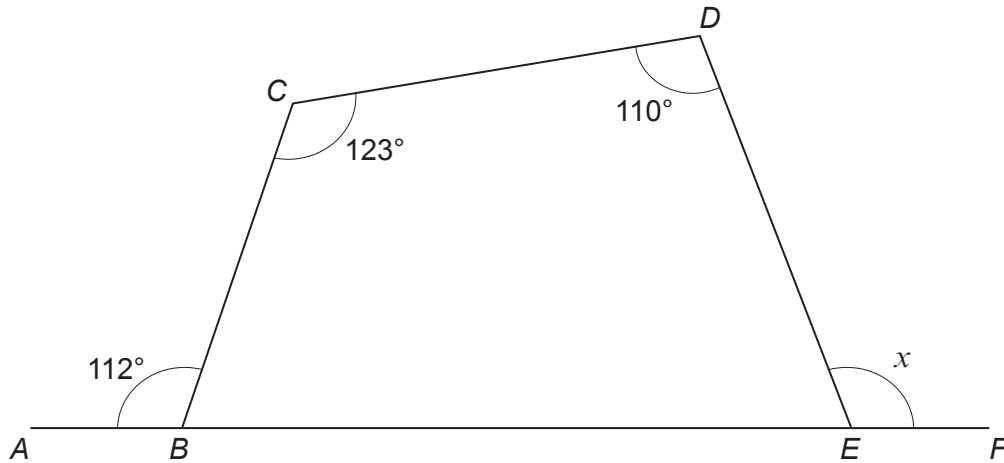


Diagram not drawn to scale

Calculate the size of angle x .
You must show all your working.

[4 + 2 OCW]

Angles on a straight line add up to 180° , so

$$\text{angle } CBE = 180^\circ - 112^\circ = 68^\circ.$$

Angles in a quadrilateral add up to 360° , so in $BCDE$

$$\text{angle } BED = 360^\circ - (68^\circ + 123^\circ + 110^\circ)$$

$$= 360^\circ - 301^\circ = 59^\circ.$$

Angles on a straight line add up to 180° , so

$$x = 180^\circ - 59^\circ = 121^\circ.$$

Therefore $x = 121^\circ$.



4. Laura puts 90 counters in a bag.
Each counter is red or blue or yellow.

Laura wants to draw a pie chart to show the number of counters of each colour.
The table below shows some of the information that she needs.

	Number of counters	Pie chart angle
Red	25	100°
Blue	45	180°
Yellow	20	80°
	Total = 90	

- (a) Complete the table.
You must show all your working.

[5]

Blue: 180° is half of 360° , so blue = $\frac{1}{2} \times 90 = 45$ counters.

Yellow = $90 - 25 - 45 = 20$ counters.

Each counter is $360^\circ \div 90 = 4^\circ$.

Red angle = $25/90 \times 360^\circ = 25 \times 4^\circ = 100^\circ$

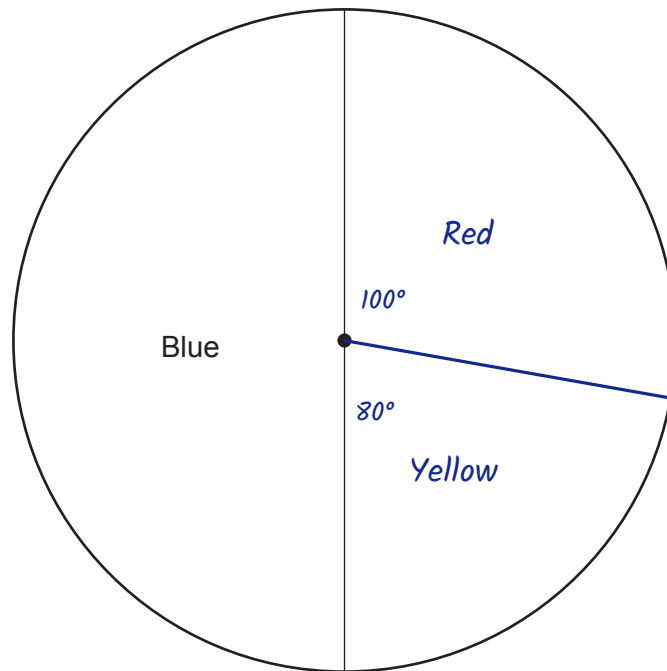
Yellow angle = $20/90 \times 360^\circ = 20 \times 4^\circ = 80^\circ$

(Check: $100^\circ + 180^\circ + 80^\circ = 360^\circ$)



- (b) Complete the pie chart to show the results.

[2]



- (c) Laura chooses a counter at random from the bag.
Calculate the probability that this counter is either red or blue.

[2]

$$\text{Red or blue} = 25 + 45 = 70 \text{ counters}$$

$$P(\text{red or blue}) = 70/90$$

$$= 7/9$$



5. (a) Write 0.034 35 correct to two significant figures.
Circle your answer.

[1]

0.03

0.033

0.0344

0.034

0.034 00

- (b) Convert 6.7 m^2 into cm^2 .
Circle your answer.

[1]

670

6700

67 000

670 000

6 700 000

- (c) Factorise $12e + 15$.
Circle your answer.

[1]

 $27e$ $3(4e + 5)$ $12(e + 15)$ $5(12e + 3)$ $15(0.8e + 3)$ 

6. Find the whole number that satisfies all of the following conditions:

- It is a whole number between 15 and 35 inclusive.
- The number is a multiple of 2 but not a multiple of 4.
- 3 is a factor of this number, but 9 is **not** a factor of this number.

[2]

Multiples of 2 but not 4 from 15 to 35: 18, 22, 26, 30, 34

Of these, multiples of 3: 18, 30

9 is a factor of 18 ($18 = 2 \times 9$) but not of 30.

The whole number is 30

7. Calculate $\frac{15 \cdot 4^2}{14 \cdot 59 - 7 \cdot 67}$, correct to 1 decimal place.

[2]

$15 \cdot 4^2 = 237.16$ $14 \cdot 59 - 7 \cdot 67 = 6.92$

$237.16 \div 6.92 = 34.27167...$

$= 34.3$ (1 d.p.)



8. 125 pupils were asked which one of four primary schools they attended.

(a) One of the pupils is chosen at random.

Complete the table below to find the probability that the pupil chosen went to Ysgol Bryn.

[2]

	Ysgol Aber	Ysgol Bryn	Ysgol Castell	Ysgol Dewi
Probability	0.08	0.44	0.2	0.28

$$P(\text{Ysgol Bryn}) = 1 - (0.08 + 0.2 + 0.28)$$

$$= 1 - 0.56 = 0.44$$

(b) How many of the 125 pupils went to Ysgol Dewi?

[2]

$$\text{Number at Ysgol Dewi} = 0.28 \times 125$$

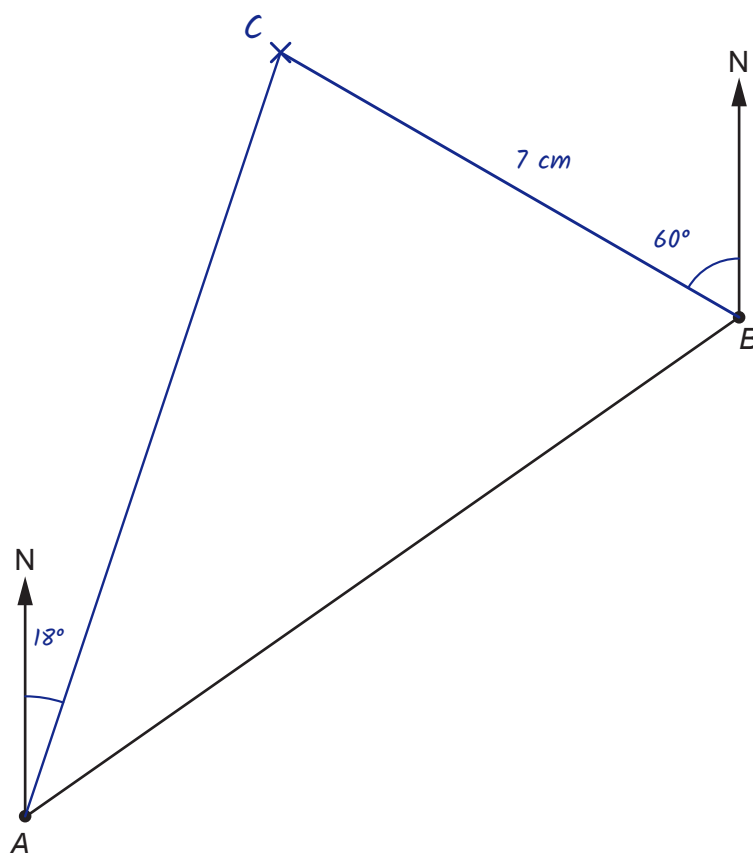
$$= 35 \text{ pupils}$$



9. Point A and point B are shown in the scale drawing below.

- (a) Point C is 35 km from point B on a bearing of 300° .
Complete the scale drawing to show the position of point C. [2]

Scale: 1 cm represents 5 km



- (b) Use your scale drawing to calculate
- the **actual** length of AC, in kilometres,
 - the bearing of point C from point A.

[2]

Bearing of C from B = 300° , so $360^\circ - 300^\circ = 60^\circ$ west of north. $BC = 35 \div 5 = 7$ cm

AC measures 10.6 cm, so $AC = 10.6 \times 5 = 53$ km. Angle at A from north = 18°

Actual length of AC = 53 km

Bearing of point C from point A = 018 $^\circ$



10. (a) Express 21.76 as a percentage of 32. [2]

$$21.76/32 \times 100\%$$

$$= 0.68 \times 100\%$$

$$= 68\%$$

- (b) Solve $5t + 3 = 3t + 14$. [3]

$$5t + 3 = 3t + 14$$

$$5t - 3t = 14 - 3$$

$$2t = 11$$

$$t = 11/2$$

$$t = 5.5$$



11. A solid metal cylinder has a radius of 2.3 cm and a height of 5 cm.

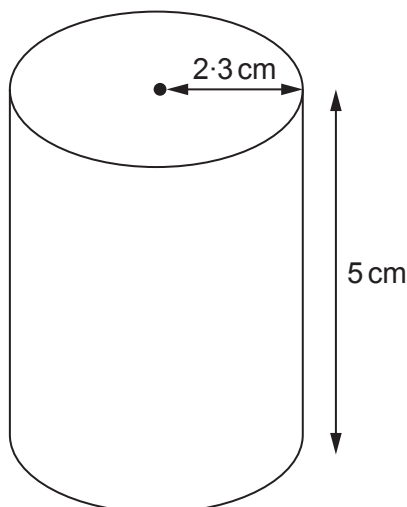


Diagram not drawn to scale

The mass of the cylinder is 423.1 g.

Find the density of the metal.

Give your answer in g/cm³.

[4]

$$\text{Volume of cylinder} = \pi r^2 h$$

$$= \pi \times 2.3^2 \times 5$$

$$= 83.0951... \text{ cm}^3$$

$$\text{Density} = \text{mass} \div \text{volume}$$

$$= 423.1 \div 83.0951...$$

$$= 5.0917...$$

$$\text{Density} = 5.09 \text{ g/cm}^3$$



12. A solution to the equation

$$x^3 + 5x - 8 = 0$$

lies between 1 and 2.

Use the method of trial and improvement to find this solution correct to 1 decimal place.
You must show all your working.

[4]

$$x = 1: \quad 1^3 + 5 \times 1 - 8 = -2 \quad \text{too small}$$

$$x = 2: \quad 2^3 + 5 \times 2 - 8 = 10 \quad \text{too big}$$

$$x = 1.5: \quad 1.5^3 + 5 \times 1.5 - 8 = 2.875 \quad \text{too big}$$

$$x = 1.2: \quad 1.2^3 + 5 \times 1.2 - 8 = -0.272 \quad \text{too small}$$

$$x = 1.3: \quad 1.3^3 + 5 \times 1.3 - 8 = 0.697 \quad \text{too big}$$

$$x = 1.25: \quad 1.25^3 + 5 \times 1.25 - 8 = 0.203125 \quad \text{too big}$$

So the solution lies between 1.2 and 1.25.

$$x = 1.2 \text{ (to 1 d.p.)}$$



13. A, B and C are points on the circumference of a circle with centre O.
The length of BC is 10 cm.
The diameter of the circle is 18 cm.

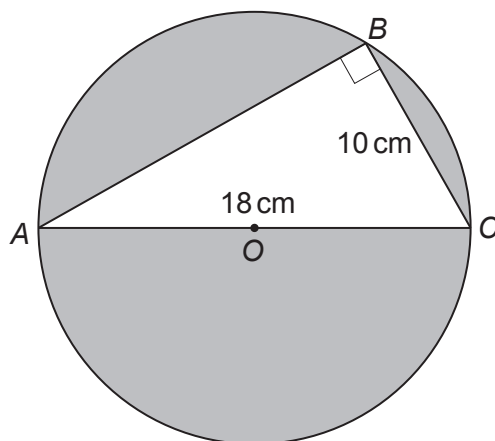


Diagram not drawn to scale

Calculate the shaded area.
You must show all your working.

[7]

AC is a diameter, so angle ABC = 90° (angle in a semicircle).

Pythagoras: $AB^2 = 18^2 - 10^2 = 324 - 100 = 224$

$AB = \sqrt{224} = 14.9666... \text{ cm}$

Area of triangle ABC = $\frac{1}{2} \times 10 \times 14.9666... = 74.8331... \text{ cm}^2$

Radius = $18 \div 2 = 9 \text{ cm}$

Area of circle = $\pi \times 9^2 = 81\pi = 254.4690... \text{ cm}^2$

Shaded area = $254.4690... - 74.8331...$

$= 179.6358...$

Shaded area = 179.6 cm^2



14. (a) The rectangle below has:
- a length of $3y$
 - a width of $y + a$
 - an area of $3y^2 + 12y$.

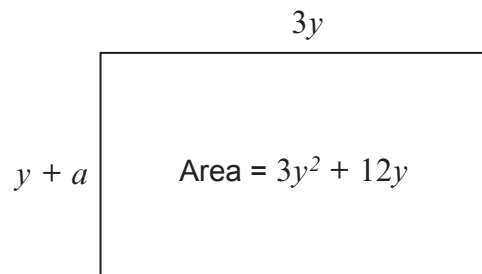


Diagram not drawn to scale

Find the value of a .
You must show all your working.

[3]

$$\text{Area} = 3y \times (y + a) = 3y^2 + 3ay$$

$$3y^2 + 3ay = 3y^2 + 12y$$

$$3ay = 12y, \text{ so } 3a = 12$$

$$a = 4$$



(b) Another rectangle has a width of $4x - 10$.

(i) Given that x is a whole number, explain why the value of x cannot be less than 3.

[1]

If $x = 2$, the width is $4 \times 2 - 10 = -2$, which is negative.

A length (side) of a rectangle cannot be negative, so $4x - 10 > 0$,

which means x must be greater than 2.5. So x cannot be less than 3.

(ii) The perimeter of the rectangle is $14x - 4$.

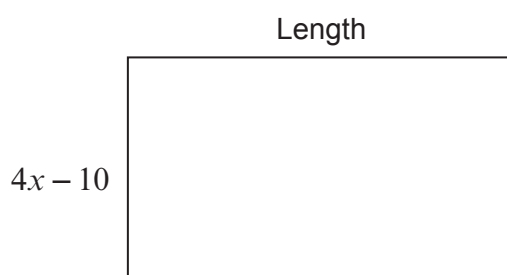


Diagram not drawn to scale

Find the length of the rectangle in **terms of x** .

[4]

Perimeter = $2 \times \text{length} + 2 \times \text{width}$

$2 \times \text{length} = 14x - 4 - 2(4x - 10)$

$= 14x - 4 - 8x + 20$

$= 6x + 16$

Length = $(6x + 16) \div 2$

Length = $3x + 8$



15. Calculate the length of the side YZ in the triangle XYZ shown below.

[3]

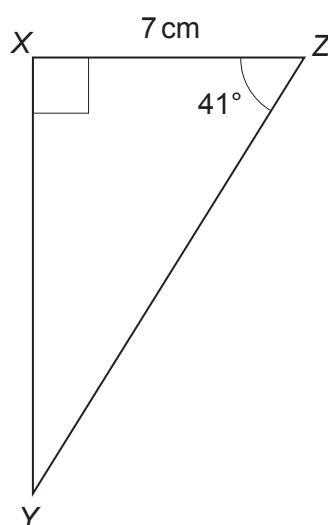


Diagram not drawn to scale

$$\cos 41^\circ = \text{adjacent/hypotenuse} = 7/YZ$$

$$YZ = 7/\cos 41^\circ$$

$$= 9.27509...$$

$$YZ = 9.28 \text{ cm}$$



16. Two times are recorded correct to the **nearest 0.1 second**.

12.4 seconds
25.5 seconds

Calculate the greatest possible difference between these times.

[3]

Upper bound of 25.5 = 25.55 s, lower bound of 12.4 = 12.35 s

Greatest difference = 25.55 - 12.35

= 13.2 seconds

17. A number has been increased by 60% to give an answer of 64.
What was the original number?

[2]

100% + 60% = 160% = 1.6

Original number = 64 ÷ 1.6

= 40



18. Bag A and Bag B contain only red and blue balls.

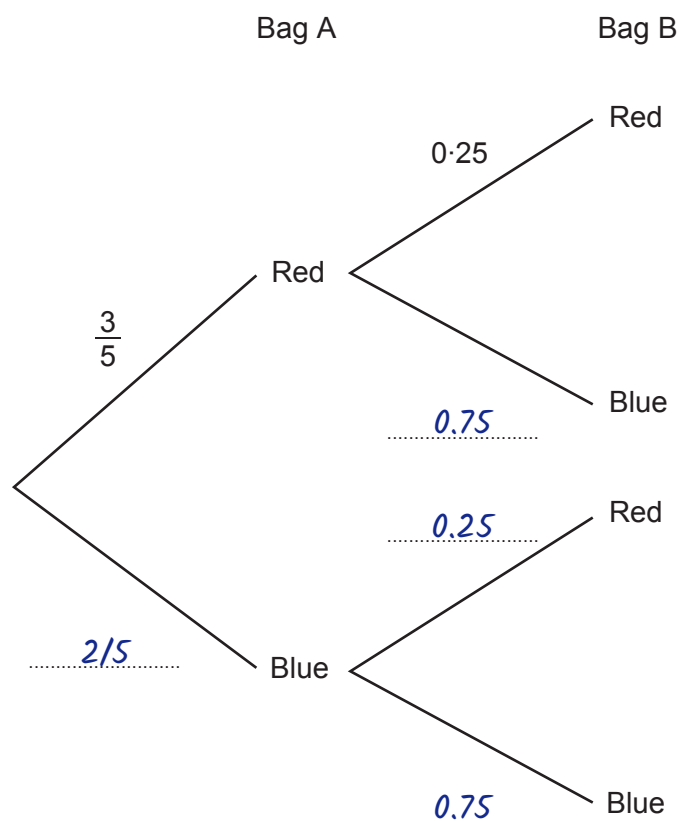
The probability of choosing a red ball from Bag A is $\frac{3}{5}$.

The probability of choosing a red ball from Bag B is 0.25.

A ball is chosen at random from each bag.

(a) Complete the tree diagram below.

[2]



(b) Find the probability that the two balls chosen are the same colour.

[3]

$$P(\text{red, red}) = \frac{3}{5} \times 0.25 = 0.15$$

$$P(\text{blue, blue}) = \frac{2}{5} \times 0.75 = 0.3$$

$$P(\text{same colour}) = 0.15 + 0.3$$

$$= 0.45$$



19. Solve the following simultaneous equations using an algebraic (not graphical) method.
Do not use a trial and improvement method.
You must show all your working.

[4]

$$3x + 5y = -2$$

$$5x + 4y = -12$$

$$3x + 5y = -2 \quad (1)$$

$$5x + 4y = -12 \quad (2)$$

$$(1) \times 4: 12x + 20y = -8$$

$$(2) \times 5: 25x + 20y = -60$$

$$\text{Subtract: } 13x = -52$$

$$x = -4$$

$$\text{Substitute into (1): } 3 \times (-4) + 5y = -2$$

$$-12 + 5y = -2$$

$$5y = 10$$

$$y = 2$$

$$x = -4, y = 2$$

END OF PAPER



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