SOLUTIONS

Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3300U40-1

S17-3300U40-1

MATHEMATICS
UNIT 2: CALCULATOR-ALLOWED
INTERMEDIATE TIER

TUESDAY, 20 JUNE 2017 – AFTERNOON

1 hour 45 minutes

ADDITIONAL MATERIALS

A calculator will be required for this paper.

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 continuation page at the back of the booklet, taking care to number the question(s) correctly.

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 **10**, the assessment will take into account the quality of your linguistic and mathematical organisation, communication and accuracy in writing.

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	7	
2.	3	
3.	2	
4.	3	
5.	2	
6.	4	
7.	5	
8.	4	
9.	3	
10.	6	
11.	4	
12.	5	
13.	4	
14.	3	
15.	3	
16.	3	
17.	5	
18.	5	
19.	2	
20.	2	
21.	5	
Total	80	

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1. *(a)* Calculate 39% of £576. [2]

$= 0.39 \times 576$

$= £224.64$

(b) Calculate $\frac{3}{7}$ of 100.

Give your answer correct to the nearest whole number. [2]

$100 \div 7 \times 3$

$= 42.8571$

≈ 43

(c) How many quarters are there in 10? [1]

1 WHOLE = 4 quarters

$\therefore$ 10 WHOLE = $10 \times 4 = 40$ quarters

(d) What **fraction** is equal to 50% of $\frac{1}{6}$? [1]

50% of $\frac{1}{6}$

$= \frac{1}{2} \times \frac{1}{6} = \frac{1}{12}$

(e) Circle the fraction that is a recurring decimal. [1]

$\frac{21}{35}$ $\frac{10}{12}$ $\frac{17}{68}$ $\frac{15}{24}$ $\frac{51}{170}$

$10 \div 12$

$= 0.8\dot{3}$

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2. Circle either TRUE or FALSE for each of the following statements. [3]

A triangle with one angle equal to 70° could be an equilateral triangle. all must be 60°	TRUE	(FALSE)
A triangle with one angle equal to 70° could be an isosceles triangle. 70°, 70°, 40°	(TRUE)	FALSE
A triangle with one angle equal to 70° could be a right-angled triangle. 70°, 90°, 20°	(TRUE)	FALSE
An isosceles triangle could have one of its angles equal to 105°. 105°, 37·5°, 37·5°	(TRUE)	FALSE
A right-angled triangle could have one of its angles equal to 105°. 90°, 105° > 180°	TRUE	(FALSE)

on their own without 3rd angle !

3. Calculate the answer when,

'the largest prime number that is a factor of 28' 1, 28, 2, 14, 4, (7) largest prime

is multiplied by

'the smallest prime number that is factor of 15'. 1, 15, (3), 5 smallest prime [2]

∴ 7 x 3 = 21

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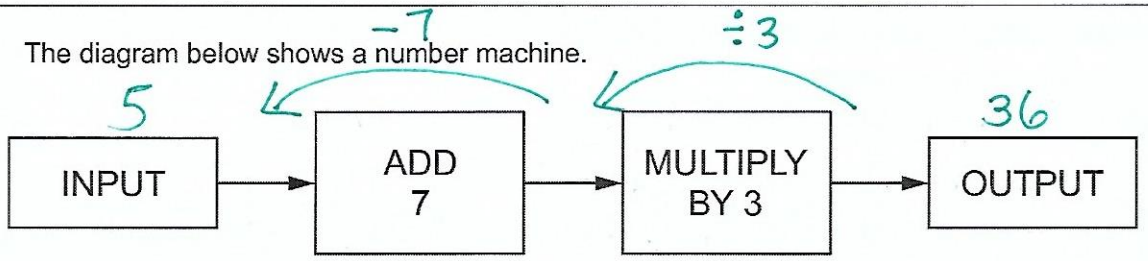
4. The diagram below shows a number machine.



Using the number machine, calculate:

(a) the INPUT when the OUTPUT is 36, [1]

$36 \div 3 - 7$

$= 12 - 7$

$= 5$

(b) the OUTPUT when the INPUT is n. [2]

$(n + 7) \times 3$

$= 3(n+7)$ or $3n + 21$

5. Write down three integers, all less than 25, whose

- range is 8, and
- mean is 13. [2]

9, 13, 17

+4 +4

The three integers are 9, 13 and 17

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6. *(a)* Write down the first three terms of the sequence whose nth term is given by $2n - 5$. [2]

$n=1$ $\quad$ $n=2$ $\quad$ $n=3$

$2(1)-5$ $\quad$ $2(2)-5$ $\quad$ $2(3)-5$

$= 2-5$ $\quad$ $= 4-5$ $\quad$ $= 6-5$

$= -3$ $\quad$ $= -1$ $\quad$ $= 1$

The first three terms are -3, -1 and 1

(b) Write down an expression for the nth term of the following sequence. [2]

7, 11, 15, 19, ...

+4 +4 +4

$4n + 3$

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7. A dice is thrown 50 times.
The number shown on the dice is recorded after each throw.
The table below shows the results recorded.

Number shown on dice	1	2	3	4	5	6
Frequency	9	7	8	7	6	13

(a) The relative frequency of throwing a 1 was calculated as $\frac{9}{50} = 0{\cdot}18$.

What was the relative frequency of throwing a 6?
Give your answer as a decimal. [1]

$\frac{13}{50} = \frac{26}{100} = 0{\cdot}26$

(b) The number 4 was thrown 7 times in the first 50 throws.
Using **this fact**, calculate how many times you would expect a 4 to be thrown when this dice is thrown 3000 times. [2]

50 throws, 7 times
100 throws 14 times
1000 throws 140 times
3000 throws 420 times

(c) How many times would you expect a 4 to be thrown when a **fair** dice is thrown 3000 times? [2]

$\frac{1}{6}$ of 3000

$= 3000 \div 6$

$= 500$

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8. *ABCDE* is a regular pentagon with centre *O*.

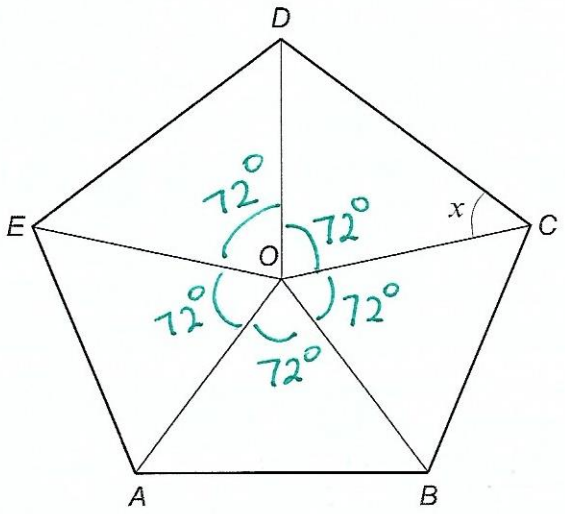

Diagram not drawn to scale

Calculate the size of angle x.
You must show all your working. [4]

Centre angles $360 \div 5 = 72°$

Use $\triangle COD$ Isosceles:

$\therefore \quad x = \dfrac{180 - 72}{2}$

$x = \dfrac{108}{2}$

$x = 54°$

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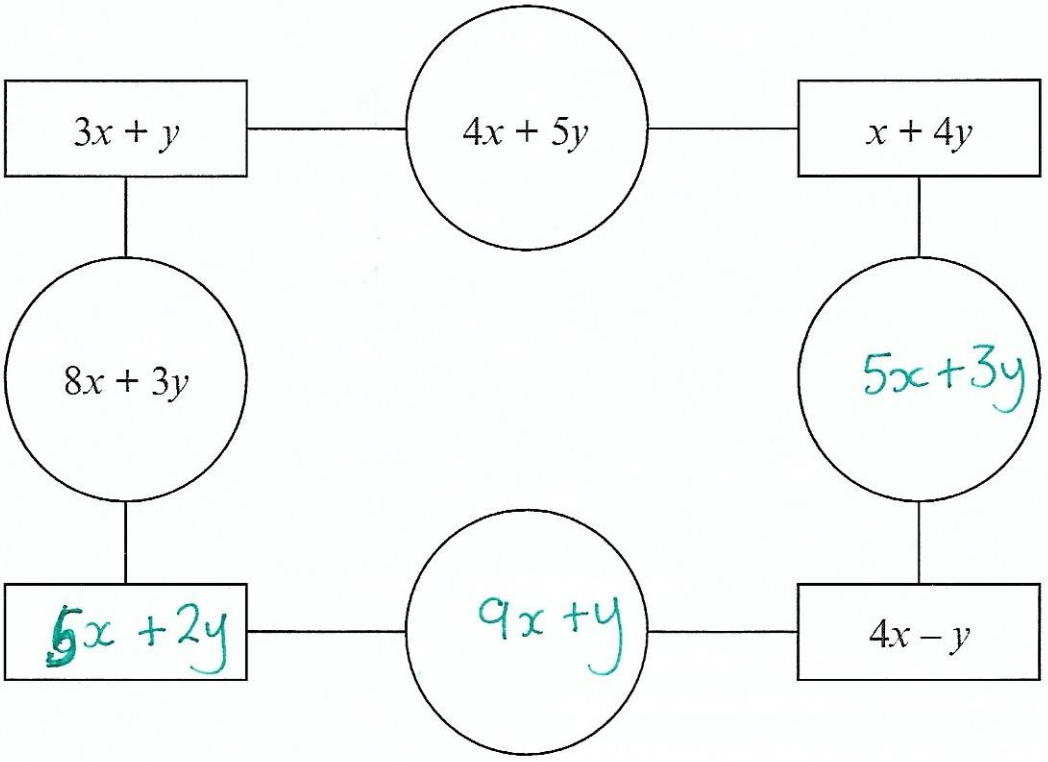
9. Look at the diagram below.
The expression in each circle is found by **adding** the expressions in the rectangles on either side of the circle.
Complete the diagram by writing expressions in the blank circles and the blank rectangle.
You must simplify your expressions. [3]



Working space: .....

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

ABCF is a rectangle.
CDEF is a trapezium.
BD is a straight line.

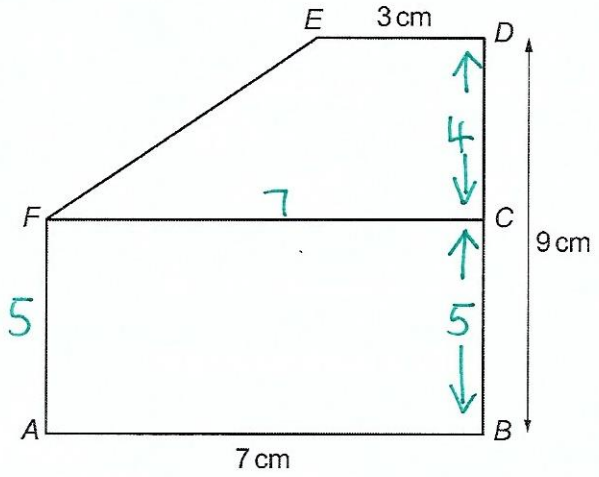

Diagram not drawn to scale

AB = 7 cm, *BD* = 9 cm and *DE* = 3 cm.

The perimeter of rectangle *ABCF* is 24 cm.

Calculate the **area** of the trapezium *CDEF*.
You must show all your working. [4 + 2 OCW]

Rectangle P = 24 cm

7 + 7 = 14 ∴ other 2 sides are 5 and 5 to give 24.

∴ AF = 5 cm BC = 5 cm

∴ CD = 9 − 5 = 4 cm

∴ Area trapezium = $\frac{(a+b)h}{2}$

$= \frac{(3+7)4}{2} = \frac{10(4)}{2}$

$= 20\text{cm}^2$

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11. *(a)* Calculate $\sqrt{8{\cdot}5^3 + (4{\cdot}5 - 0{\cdot}76)^2}$, correct to 3 significant figures. [2]

$= \sqrt{614{\cdot}125 + 13{\cdot}9876}$

$= \sqrt{628{\cdot}1126} = 25{\cdot}06217$

$\approx 25{\cdot}1$ to 3 sig fig

(b) Calculate the reciprocal of $-0{\cdot}07$, correct to 1 decimal place. [2]

$\frac{1}{-0{\cdot}07} = 1 \div (-0{\cdot}07)$

$= -14{\cdot}2857$

$\approx -14{\cdot}3$

12. Show that the triangle below is **not** a right-angled triangle. [5]

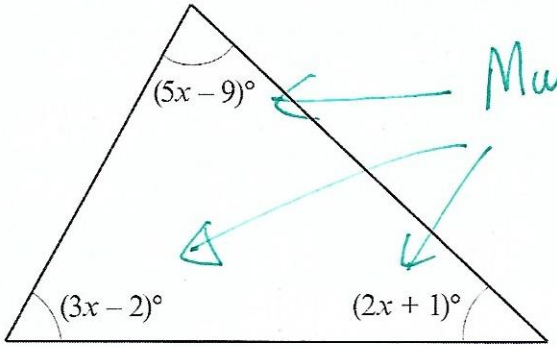

Diagram not drawn to scale

Must all add up to 180° !!!

$5x - 9 + 3x - 2 + 2x + 1 = 180$

$10x - 10 = 180$

$10x = 180 + 10$

$10x = 190$

$x = \frac{190}{10}$

$x = 19°$

So $5x - 9$

$= 5(19) - 9$

$= 95 - 9$

$= 86°$

$3x - 2$

$= 3(19) - 2$

$= 57 - 2$

$= 55°$

$2x + 1$

$= 2(19) + 1$

$= 38 + 1$

$= 39°$

∴ Not right-angled

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13. A solution to the equation

$$x^3 - 2x - 45 = 0$$

lies between 3 and 4.

Use the method of trial and improvement to find this solution correct to 1 decimal place.
You must show all your working. [4]

Guess $x = 3.5$

$\rightarrow$ LHS $= 3.5^3 - 2(3.5) - 45 = -9.125$ Too small

left hand side

Guess $x = 3.7$

LHS $= 3.7^3 - 2(3.7) - 45 = -1.747$ Too small

Guess $x = 3.8$

LHS $= 3.8^3 - 2(3.8) - 45 = +2.272$ Too BIG

3.8 Bit ↓

3.75 BIG ↓

↑ 3.7 small

Try $x = 3.75$

LHS $= 3.75^3 - 2(3.75) - 45$

$= +0.234375$ Too big

$\therefore$ $x = 3.7$ to 1 d.p.

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14. A right-angled triangle *LMN* is shown below.
LN = 16·9 cm and *LM* = 6·5 cm.

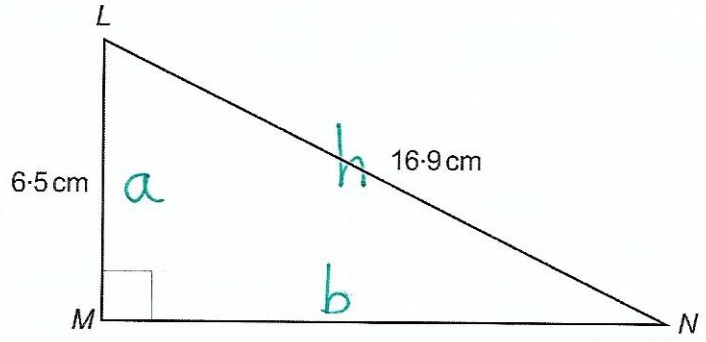

Diagram not drawn to scale

Calculate the length *MN*. [3]

$h^2 = a^2 + b^2$

$16.9^2 = 6.5^2 + MN^2$

$285.61 = 42.25 + MN^2$

$285.61 - 42.25 = MN^2$

$243.36 = MN^2$

$15.6\text{ cm} = MN$

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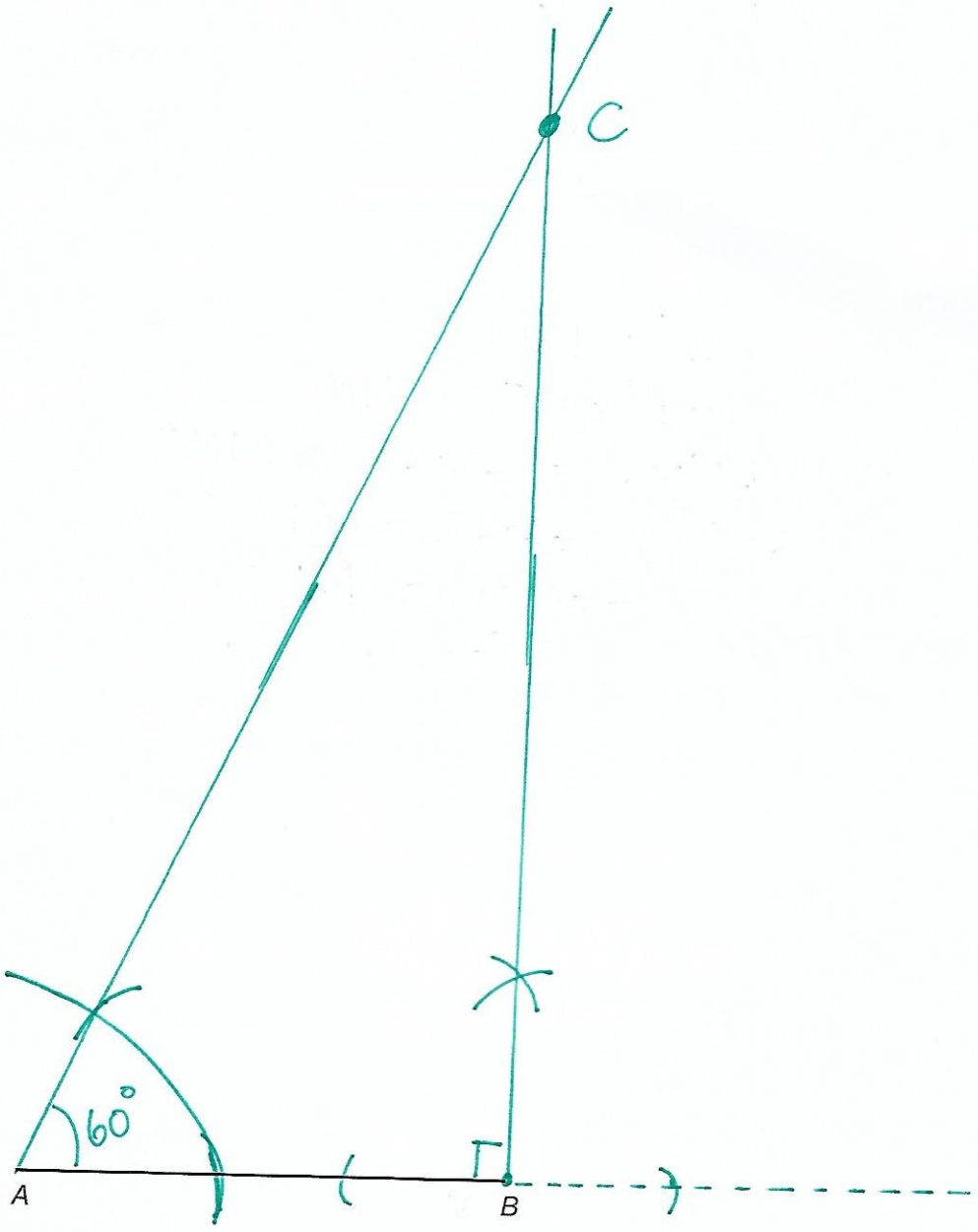
15. Construct an accurate drawing of triangle ABC, where $AB = 7$ cm, $A\hat{B}C = 90°$ and $B\hat{A}C = 60°$.
Use only a ruler and a pair of compasses.
The side AB has been drawn for you.
You must show your construction arcs.

[3]



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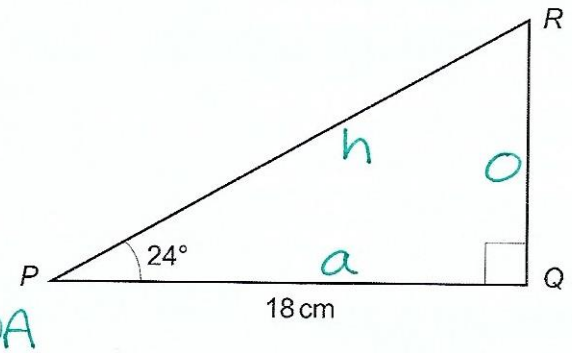
16. Calculate the length of the side *QR* in the triangle *PQR* shown below. [3]



SOHCAHTOA

Diagram not drawn to scale

$\tan x = \frac{O}{a}$

$\tan 24^\circ = \frac{QR}{18}$

$18 \tan 24^\circ = QR$

$8.0 \text{ cm} = QR.$

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17. 100 boxes each contain 10 balls.

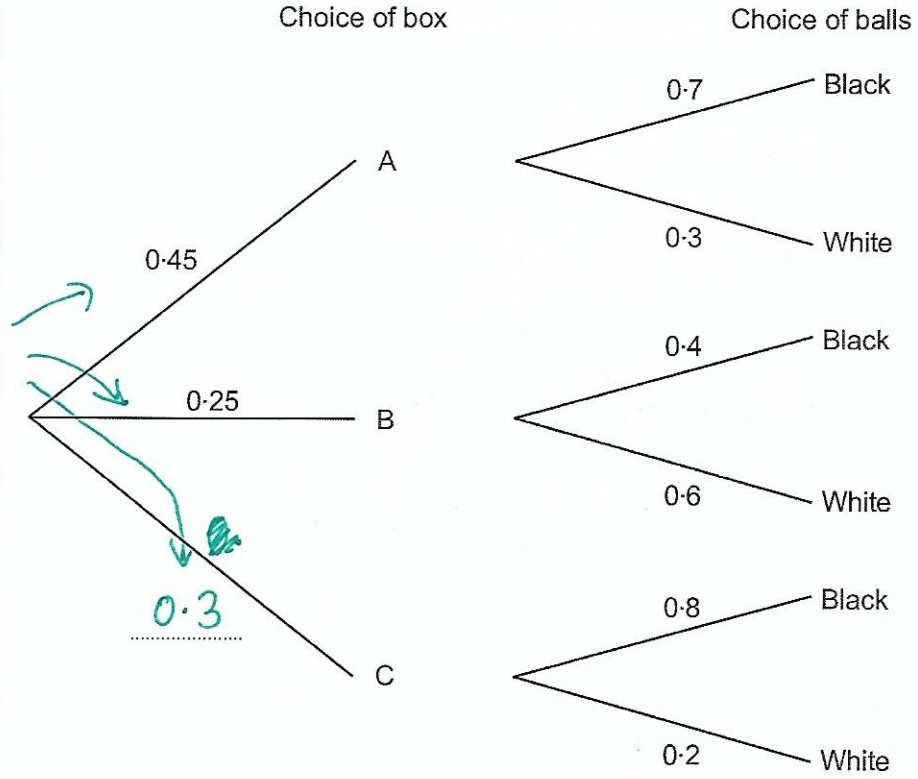
45 of the boxes are labelled A.
They each contain 7 black balls and 3 white balls.

25 of the boxes are labelled B.
They each contain 4 black balls and 6 white balls.

The rest of the boxes are labelled C.
They each contain 8 black balls and 2 white balls.

In a game, a player chooses a box at random, and then chooses a ball at random from that box.

(a) Complete the tree diagram shown below. [1]



must to add up to 1

(b) What is the probability that a player will select a black ball? [3]

P(A and Black OR B and Black OR C and Black)
= (0·45×0·7) + (0·25×0·4) + (0·3×0·8)
= 0·315 + 0·1 + 0·24
= 0·655

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(c) If a large number of people played the game, approximately what fraction of them would you expect to choose a white ball?
Circle your answer. [1]

$\frac{1}{10}$ $\frac{1}{5}$ $\frac{1}{4}$ $\frac{1}{3}$ $\frac{1}{2}$

P(white) = 0·345 (1 − 0·655)

Now $\frac{1}{3}$ = 0·333... which is closest

18. (a) Factorise $x^3 - 5x$. [1]

$x(x^2 - 5)$

(b) Expand and simplify $(2x - 3)(x + 4)$. [2]

$= 2x^2 + 8x - 3x - 12$

$= 2x^2 + 5x - 12$

(c) Factorise $x^2 - 3x - 28$. [2]

$= (x - 7)(x + 4)$

×	+
−28	−3

(−7)(+4)

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19. *(a)* Circle the equation of a straight line that is parallel to the line $3y = 2x + 6$. [1]

$y = \frac{2}{3}x + 2$

$3y = 2x + 7$ $\quad 2y = 3x + 6$ $\quad 3y = -2x + 6$ $\quad -3y = 2x + 6$ $\quad 2y = -3x + 6$

$y = \frac{2}{3}x + \frac{7}{3}$

Both have gradient of $+\frac{2}{3}$
so they slope the same. ie. parallel.

(b) Circle the equation of a straight line that is perpendicular to the line $y = 5x - 3$. [1]

slope = 5

$y = \frac{x}{5} + 3$ $\quad y = 5x + 3$ $\quad y = 5x + \frac{1}{3}$ $\quad y = -5x + 3$ $\quad y = \frac{-x}{5} + 3$

slope is $-\frac{1}{5}$

perpendicular lines are at 90°.
TEST is : $5 \times (-\frac{1}{5}) = -1$

20. Points *A*, *B* and *C* lie on the circumference of a circle, centre *O*.
$A\hat{C}B = 37°$.

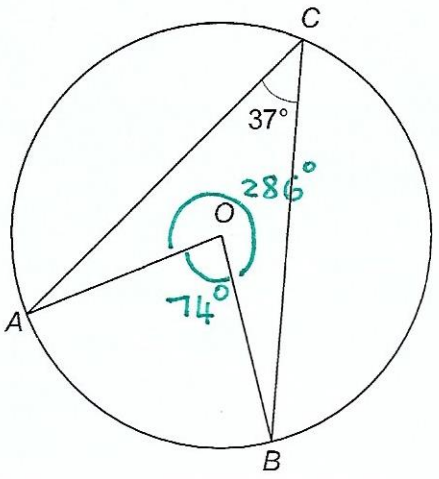

Diagram not drawn to scale

Calculate the size of the **reflex** angle $A\hat{O}B$. [2]

$360 - 74$
$= 286°$

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21. The area of triangle *ABD*, shown in the diagram below, is 35 cm^2.
AD = 5 cm and *BC* = 32 cm.
D is on the line *AC*, and *BD* is perpendicular to *AC*.

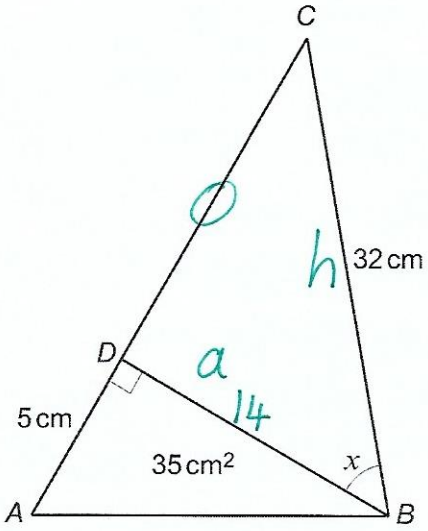

Diagram not drawn to scale

Calculate the size of angle x.
You must show all your working. [5]

$\triangle ABD$

Area $A = \frac{bh}{2}$

$35 = \frac{5 \times BD}{2}$

$70 = 5BD$

$\frac{70}{5} = BD$

$14\text{ cm} = BD$

$\triangle BCD$ SOHCAHTOA

$\cos x = \frac{a}{h}$

$\cos x = 14/32$

$x = \cos^{-1}(14/32)$

$x = 64.1^\circ$

END OF PAPER

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