

Surname	Centre Number	Candidate Number
Other Names		0



GCSE – NEW

3300U50-1

**MATHEMATICS
UNIT 1: NON-CALCULATOR
HIGHER TIER**



SOLUTIONS

TUESDAY, 13 JUNE 2017 – MORNING

1 hour 45 minutes

ADDITIONAL MATERIALS

The use of a calculator is not permitted in 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 continuation page at the back of the booklet, taking care to number the questions correctly.

Take π as 3.14.

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 5, the assessment will take into account the quality of your linguistic and mathematical organisation and communication.

In question 10, the assessment will take into account the quality of your linguistic and mathematical accuracy in writing.

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



JUN173300U50101

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1.	4	
2.	5	
3.	4	
4.	3	
5.	4	
6.	3	
7.	5	
8.	4	
9.	2	
10.	6	
11.	6	
12.	5	
13.	5	
14.	3	
15.	3	
16.	6	
17.	6	
18.	4	
19.	2	
Total	80	



JUN173300U50101

1. Ceri has a set of cards.
Each of her cards is labelled North, East, South or West.

The table below shows the probability distribution when a card is taken from the set of cards at random.

Label	North	East	South	West
Probability	0.4	0.25	0.2	0.15

- (a) Ceri chooses one card at random from her set of cards.

What is the probability that the card is labelled East or South? [2]

$$0.25 + 0.2$$

$$= 0.45$$

- (b) Sasha has an identical set of cards.
Ceri and Sasha each choose one card at random from their set of cards.

What is the probability that they both choose a card labelled North? [2]

$$P(N \text{ and } N)$$

$$= 0.4 \times 0.4$$

$$= 0.16$$



2. The table below shows some of the values of $y = x^2 - 5x + 2$, for values of x from -1 to 5 .

x	-1	0	1	2	3	4	5
$y = x^2 - 5x + 2$	8	2	-2	-4	-4	-2	2

- (a) Complete the table above.

[1]

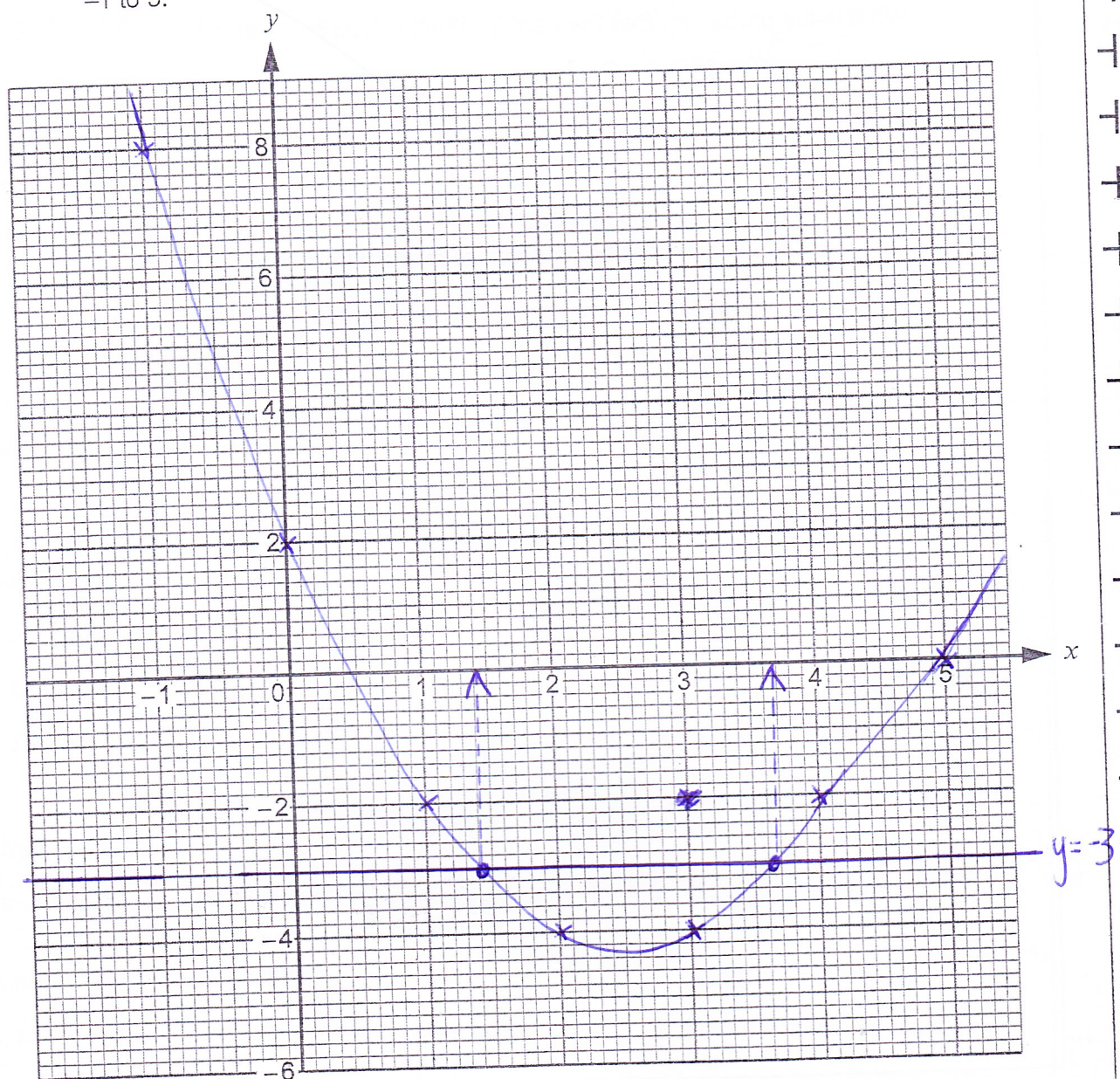
$$y = (3)^2 - 5(3) + 2$$

$$y = 9 - 15 + 2$$

$$y = -4$$

- (b) On the graph paper below, draw the graph of $y = x^2 - 5x + 2$ for values of x from -1 to 5 .

[2]

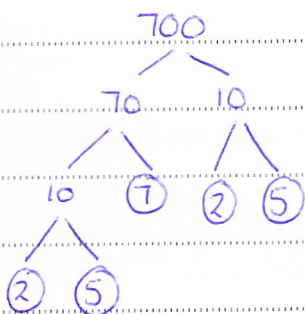


- (c) Draw the line $y = -3$ on the graph paper.

Write down the values of x where the line $y = -3$ cuts the curve $y = x^2 - 5x + 2$.
Give your answers correct to 1 decimal place. [2]

Values of x are 1.4 and 3.7

3. (a) Express 700 as a product of its prime factors in index form. [3]



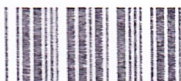
$$700 = 2 \times 2 \times 5 \times 5 \times 7$$

$$= 2^2 \times 5^2 \times 7$$

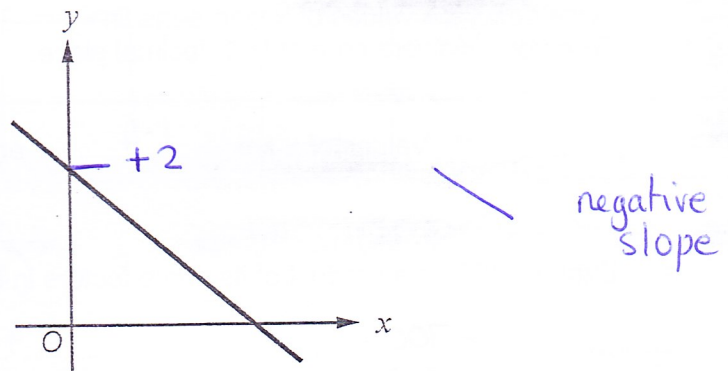
- (b) The number 33554432 is equal to 2^{25} .

Explain how this tells you that 33554432 is not a square number. [1]

because you need an even power for
it to be a square quantity.
25 is an odd valued power.



4. (a)



Which **one** of the following equations could represent the line shown in the graph above?
Circle your answer. [1]

$y = -x - 2$

$y = -x + 2$

$y = x + 2$

$y = x - 2$

$y = -x$

(b) Which **one** of the following points lies on the line $2y = 3x + 4$?
Circle your answer. [1]

$(2, -5)$

$(5, 2)$

$(-2, 5)$

$(2, 5)$

$(-2, -5)$

$2y = 3x + 4$

Try $(2, 5)$

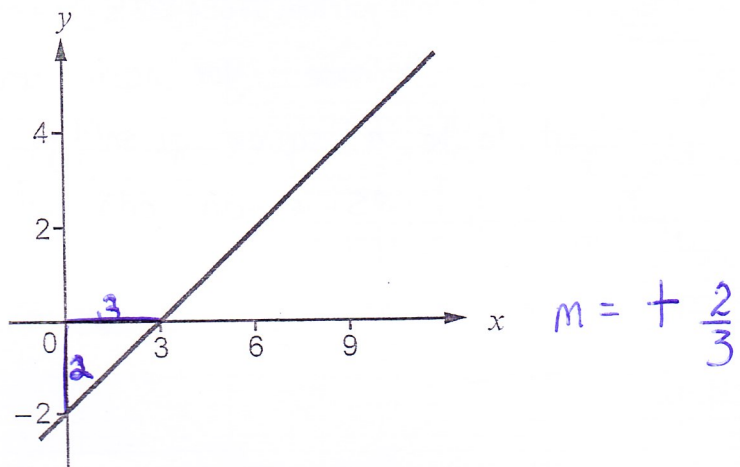
$2(5) = 3(2) + 4$

$10 = 6 + 4$

✓

$\therefore (2, 5)$

(c)



What is the gradient of the line shown in the graph above?
Circle your answer. [1]

$\frac{3}{2}$

$-\frac{3}{2}$

$\frac{2}{3}$

$-\frac{2}{3}$

-6



5. In this question, you will be assessed on the quality of your organisation and communication.

A **whole** number is written on a card.

You are given three clues to help you work out the number on the card.

Clue 1 : **Double** the number is between 8 and 18 inclusive.

Clue 2 : The number is a prime number.

Clue 3 : The number is **not** a factor of 100.

What is the number on the card?
You must show all your working.

[3 + 1 OC]

From clue 1 : Number is between 4 and 9

From clue 2 : Prime numbers between 4 and 9 are 5 and 7

From Clue 3 : Not a factor of 100

means it can't be 5.

So 7 is answer

The number on the card is 7



6. In the following formulae, each measurement of length is represented by a letter.

Consider the dimensions implied by the formulae.

Write down, for each case, whether the formula could be for a length, an area, a volume or none of these.

[3]

The first one has been done for you.

<u>Formula</u>	<u>Formula could be for</u>
$d^3 - 3 \cdot 14 r^2 h$	 volume
$d^2 + hw$ area + area = area	 area
$d + w + h$ $L + L + L = \text{length}$	 length
$2\pi r - \pi r^2$ length - area = impossible	 none
$(d + h)w$ $(L) \times w = \text{area}$	 area
$d^3 + dwh$ vol + vol = volume	 volume



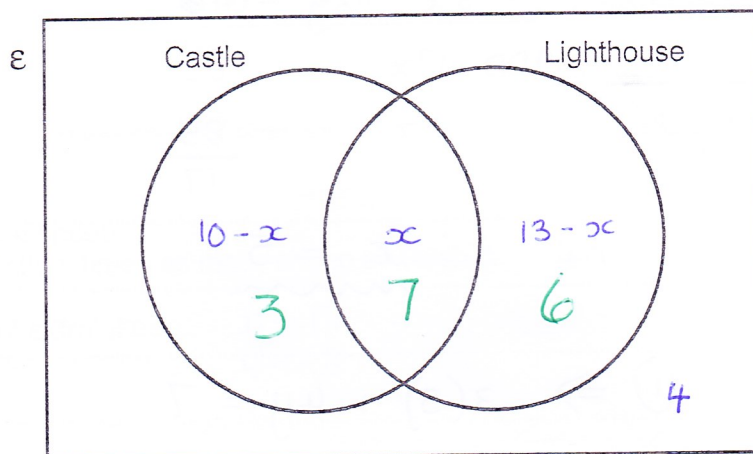
7. A group of 20 people visited Anglesey for a weekend break.

- 10 of the group visited Beaumaris Castle.
- 13 of the group visited South Stack Lighthouse.
- 4 of the group did not visit either of these places.

(a) Complete the Venn diagram below to show this information.
The universal set, ϵ , contains all of the 20 people in the group.

[3]

Let x
be in both
Castle and
Lighthouse



$$10 - x + x + 13 - x + 4 = 20$$

$$27 - x = 20$$

$$27 - 20 = x$$

$$7 = x$$

$\therefore$ Answer in green in diagram

(b) One person is chosen at random from the group.
What is the probability that this person visited only one of the two places?

[2]

$P(\text{Castle only OR Lighthouse only})$

$$= \frac{3 + 6}{20}$$

$$= \frac{9}{20}$$



8. Solve the following simultaneous equations using an algebraic (not graphical) method. [4]

$$\begin{array}{rcl} 3x + 4y = 7 & \text{---} & \textcircled{1} \times 3 \\ 2x - 3y = 16 & \text{---} & \textcircled{2} \times 4 \end{array}$$

$$9x + 12y = 21$$

$$8x - 12y = 64$$

$$\text{ADD } 17x = 85$$

$$x = \frac{85}{17}$$

$$\underline{x = 5}$$

$$\textcircled{1} \Rightarrow 3(5) + 4y = 7$$

$$15 + 4y = 7$$

$$4y = 7 - 15$$

$$4y = -8$$

$$y = \frac{-8}{4}$$

$$\underline{y = -2}$$

$$\left. \begin{array}{l} x = 5 \\ y = -2 \end{array} \right\} \text{ANSWER}$$



9. Calculate the value of $(5.41 \times 10^5) + (2.3 \times 10^4)$.
Give your answer in standard form.

[2]

$$= 5.41 \times 10^5 + 0.23 \times 10^5$$

$$= 5.64 \times 10^5$$

10. In this question, you will be assessed on the quality of your linguistic and mathematical accuracy in writing.

Rashid owned n sheep.

Eifion had exactly 4 times as many sheep as Rashid.

$4n$

Rashid buys 17 extra sheep.

$n + 17$

Eifion sells 8 of his sheep.

$4n - 8$

Eifion still has more sheep than Rashid.

Form an inequality, in terms of n .

Solve the inequality to find the **least** value of n .

You must show all your working.

[5 + 1 W]

From the expressions above

$$4n - 8 > n + 17$$

↑

more than

$$4n - n > 17 + 8$$

$$3n > 25$$

$$n > \frac{25}{3}$$

$$n > 8\frac{1}{3}$$

∴ Least value of $n = 9$



11. (a) Evaluate $49^{-\frac{1}{2}}$.

[1]

$$= \frac{1}{49^{\frac{1}{2}}} = \frac{1}{\sqrt{49}} = \frac{1}{7}$$

(b) Express $0.\dot{3}\dot{7}\dot{2}$ as a fraction.

[2]

$$\text{Let } x = 0.\dot{3}\dot{7}\dot{2}$$

$$(10x) = 3.\dot{7}\dot{2}$$

$$(1000x) = 372.\dot{7}\dot{2}$$

$$\text{SUBTRACT } 990x = 369$$

$$x = \frac{369}{990}$$

(c) Find the value of $(\sqrt{63} - \sqrt{7})^2$.

[3]

$$= (\sqrt{63} - \sqrt{7})(\sqrt{63} - \sqrt{7})$$

$$= 63 - \sqrt{7}\sqrt{63} - \sqrt{7}\sqrt{63} + 7$$

$$= 70 - \sqrt{7}\sqrt{7}\sqrt{9} - \sqrt{7}\sqrt{7}\sqrt{9}$$

$$= 70 - 7\sqrt{9} - 7\sqrt{9}$$

$$= 70 - 14\sqrt{9}$$

$$= 70 - 14(3)$$

$$= 70 - 42$$

$$= 28$$

$$\text{OR alternatively } (\sqrt{63} - \sqrt{7})^2$$

$$= (\sqrt{9}\sqrt{7} - \sqrt{7})^2$$

$$= (3\sqrt{7} - \sqrt{7})^2$$

$$= (2\sqrt{7})^2$$

$$= 2\sqrt{7} \times 2\sqrt{7}$$

$$= 4(7) = 28$$



12. A, B and C are points on the circumference of a circle.
XY is a tangent to the circle at the point A.

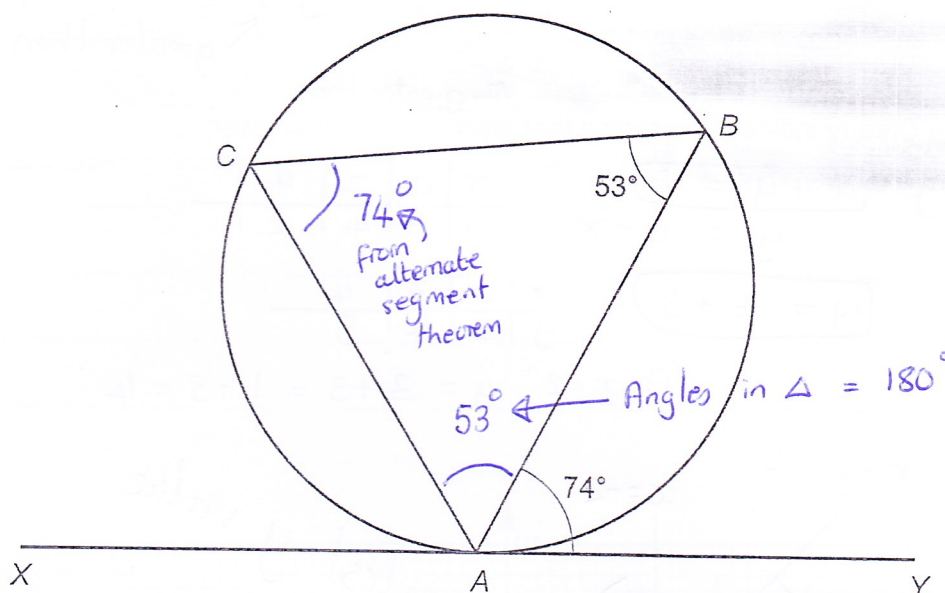


Diagram not drawn to scale

$\widehat{BAY} = 74^\circ$ and $\widehat{ABC} = 53^\circ$.

Prove that triangle ABC is an isosceles triangle.

You must give a reason for any statement that you make or any calculation that you carry out.

[5]

First $\widehat{ACB} = 74^\circ$ because of alternate segment theorem.

Then angles in $\triangle ABC = 180^\circ$

$$\therefore \widehat{BAC} = 180 - 53 - 74 = 53^\circ$$

$\therefore$ There are 2 angles of 53° $\widehat{BCA}$ and $\widehat{ABC}$.

$\therefore$ Isosceles Triangle



13. (a) On the graph paper below, draw the region which satisfies all of the following inequalities.

$$x + y \leq 6$$

$$y \leq 6 - x$$

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

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

$$x \geq -2$$

← greater than

less than

↑ greater than

Clearly indicate the region that represents your answer.

[3]

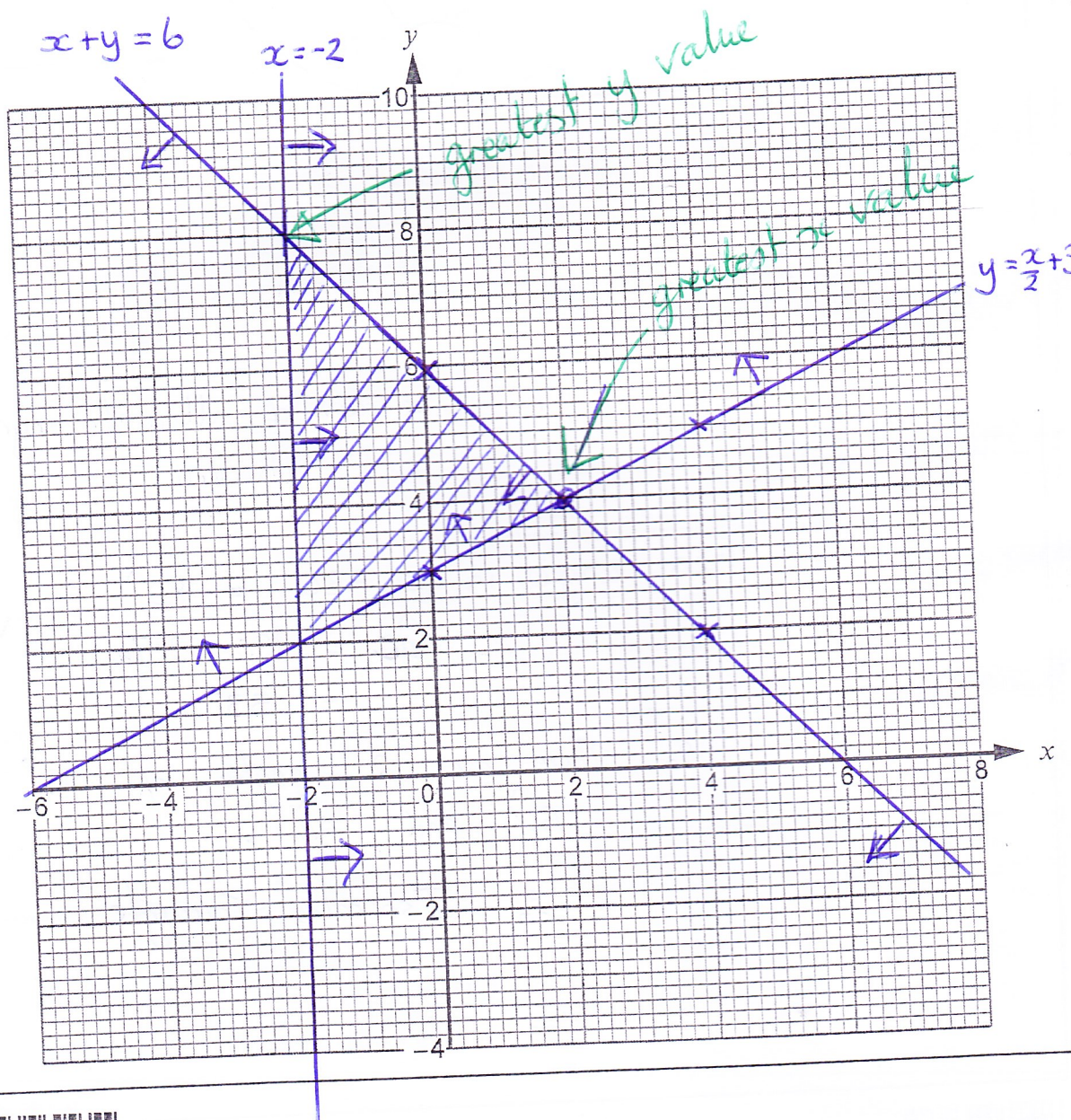
Boundary $x + y = 6$
 $y = 6 - x$

x	0	2	4
y	6	4	2

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

x	0	2	4
y	3	4	5

If $x = 2$ $y = \frac{2}{2} + 3 = 1 + 3 = 4$



- (b) (i) What is the greatest possible value of x such that all three conditions are met? [1]

$x = \dots\dots\dots 2 \dots\dots\dots$

- (ii) What is the greatest possible value of y such that all three conditions are met? [1]

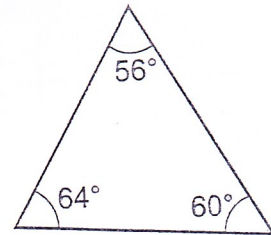
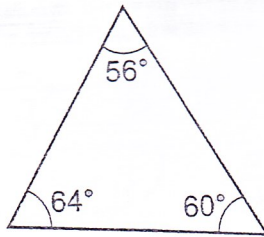
$y = \dots\dots\dots 8 \dots\dots\dots$



14. SSS, SAS, ASA and RHS are notations used to describe the conditions required to prove that two triangles are congruent.
[S $\equiv$ Side, A $\equiv$ Angle, R $\equiv$ Right angle and H $\equiv$ Hypotenuse.]

The following triangles are **not** drawn to scale.
For each pair of triangles, circle the correct statement.

(a)



congruent:
SSS

congruent:
SAS

congruent:
ASA

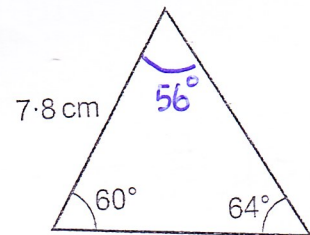
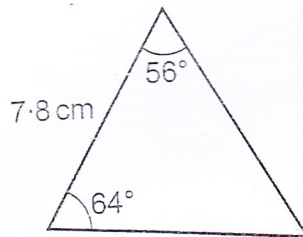
congruent:
RHS

definitely
not congruent

not necessarily
congruent

*If all angles are equal,
sides are equal.*

(b)



congruent:
SSS

congruent:
SAS

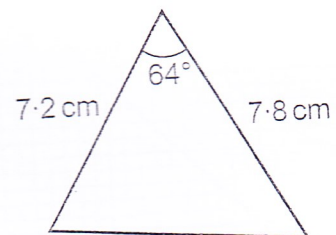
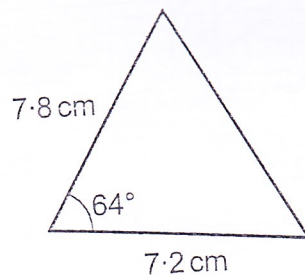
congruent:
ASA

congruent:
RHS

definitely
not congruent

not necessarily
congruent

(c)



congruent:
SSS

congruent:
SAS

congruent:
ASA

congruent:
RHS

definitely
not congruent

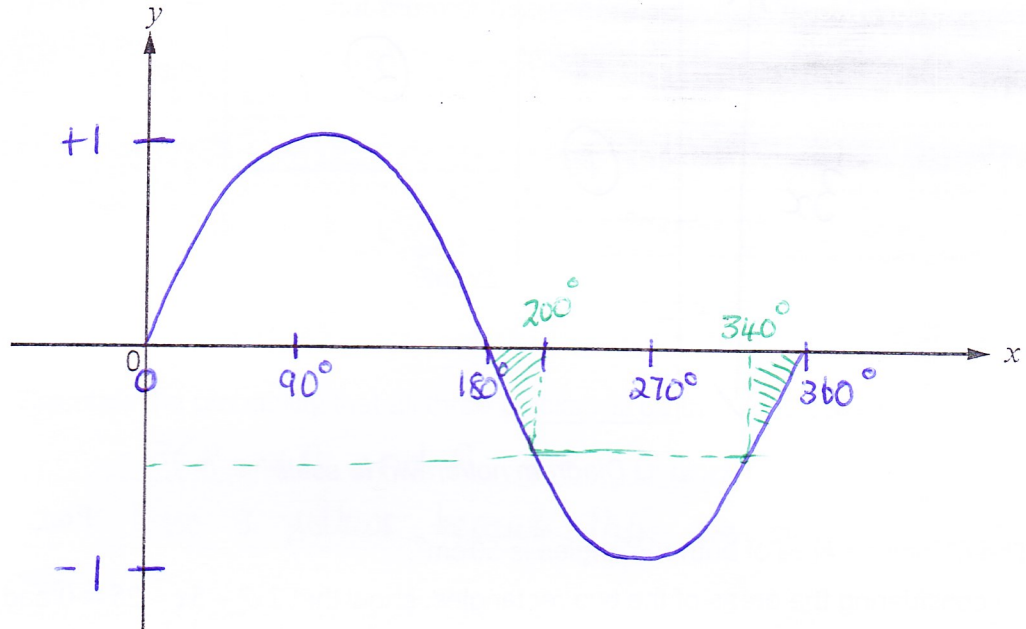
not necessarily
congruent



No table of values

17

15. (a) Using the axes below, sketch the graph of $y = \sin x$ for values of x from 0° to 360° . You must label any important values on both axes. [2]



- (b) Circle the value that is equal to $\sin 200^\circ$.

$\sin 20^\circ$

$\sin 100^\circ$

$\sin 160^\circ$

$\sin 220^\circ$

$\sin 340^\circ$

From symmetry in diagram



16. The diagram shows two rectangles.

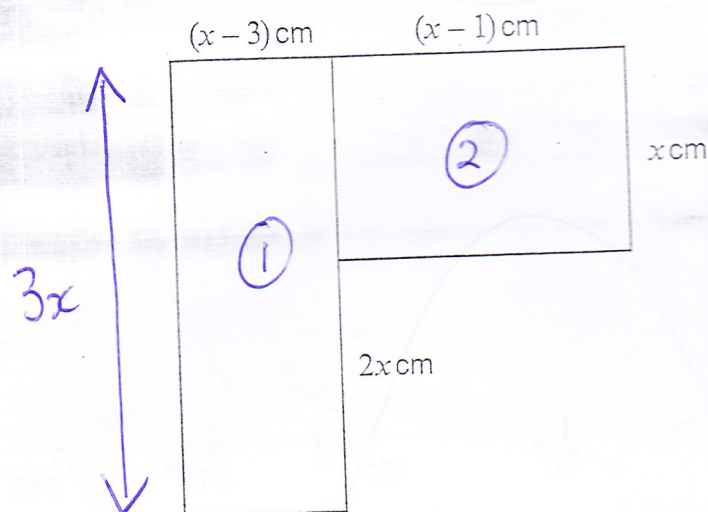


Diagram not drawn to scale

The combined area of both rectangles is 50 cm^2 .

By considering the areas of the two rectangles, show that $2x^2 - 5x - 25 = 0$ and hence find the value of x . [6]

$$\text{Total area} = \text{①} + \text{②}$$

$$50 = (x-3)3x + (x-1)x$$

$$50 = 3x^2 - 9x + x^2 - x$$

$$50 = 4x^2 - 10x$$

$$0 = 4x^2 - 10x - 50$$

$$\div 2 \quad 0 = 2x^2 - 5x - 25$$

$$\text{OR} \quad 2x^2 - 5x - 25 = 0$$

USE HARD TABLE METHOD

$$2x^2 - 10x + 5x - 25 = 0$$

$$2x(x-5) + 5(x-5) = 0$$

$$(x-5)(2x+5) = 0$$

either

$$x-5=0$$

$$x=5$$

or

$$2x+5=0$$

$$2x=-5$$

$$x=-5/2$$

IMPOSSIBLE

$$\therefore x = 5 \text{ cm}$$



17. A bag contains 6 red blocks, 4 green blocks and 2 yellow blocks.
Three blocks are taken from the bag, at random, without replacement.

- (a) What is the probability that the first block removed is red, the second is green and the third is yellow? [2]

$$\begin{aligned}
 & P(R \text{ and } G \text{ and } Y) \\
 &= \frac{6}{12} \times \frac{4}{11} \times \frac{2}{10} \\
 & \text{cancel} \rightarrow \frac{1}{2} \times \frac{4}{11} \times \frac{1}{5} \leftarrow \text{cancel} \\
 &= \frac{1 \times 4 \times 1}{2 \times 11 \times 5} = \frac{4}{110} = \frac{2}{55}
 \end{aligned}$$

- (b) Calculate the probability that all three blocks will be the same colour. [3]

$$P(R \text{ and } R \text{ and } R \text{ OR } G \text{ and } G \text{ and } G)$$

* You can't have 3 yellows because there are only 2 yellows to start

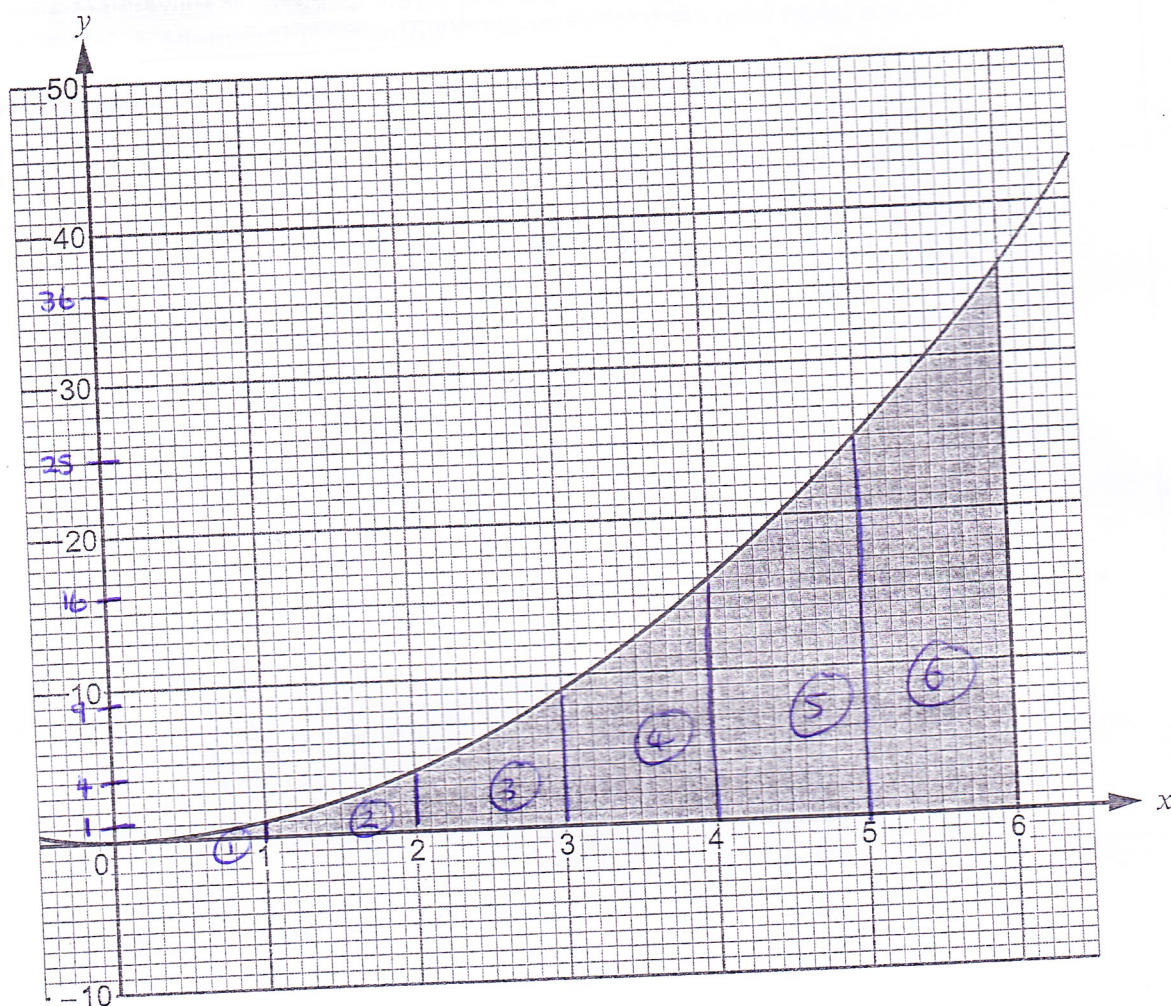
$$\begin{aligned}
 &= \left(\frac{6}{12} \times \frac{5}{11} \times \frac{4}{10} \right) + \left(\frac{4}{12} \times \frac{3}{11} \times \frac{2}{10} \right) \\
 &= \frac{120}{1320} + \frac{24}{1320} \\
 &= \frac{144}{1320} = \frac{72}{660} = \frac{36}{330} = \frac{18}{165} = \frac{6}{55}
 \end{aligned}$$

- (c) Write down the probability that the three blocks will **not** be the same colour. [1]

$$\begin{aligned}
 & \text{so } 1 - \frac{6}{55} \\
 &= \frac{55}{55} - \frac{6}{55} \\
 &= \frac{49}{55}
 \end{aligned}$$



18. The graph of $y = x^2$ has been drawn below, for values of x from $x = 0$ to $x = 6$.



Use the trapezium rule, with the ordinates $x = 0, x = 1, x = 2, x = 3, x = 4, x = 5$ and $x = 6$, to estimate the area of the shaded region shown above.

$$\text{Area} = \textcircled{1} + \textcircled{2} + \textcircled{3} + \textcircled{4} + \textcircled{5} + \textcircled{6}$$

$$A = \frac{bh}{2} + \frac{(a+b)h}{2} + \frac{(a+b)h}{2} + \frac{(a+b)h}{2} + \frac{(a+b)h}{2} + \frac{(a+b)h}{2}$$

$$A = \frac{1 \times 1}{2} + \frac{(1+4)1}{2} + \frac{(4+9)1}{2} + \frac{(9+16)1}{2} + \frac{(16+25)1}{2} + \frac{(25+36)1}{2}$$

$$A = \frac{1}{2} + \frac{5}{2} + \frac{13}{2} + \frac{25}{2} + \frac{41}{2} + \frac{61}{2}$$

$$A = \frac{146}{2} = 73 \text{ units}^2$$



19. By considering algebraic expressions, show that it will never be possible for the surface area of a sphere of radius r to be equal to the surface area of a cube with sides of length r . [2]

Sphere

$$A = 4\pi r^2$$

Cube

$$A = 6r^2$$

6 faces $r \times r$

$$\text{Try } 4\pi r^2 = 6r^2$$

$$\div r^2 \quad 4\pi = 6,$$

$$4\pi$$

$$\text{but } 4\pi \neq 6$$

$$\approx 4 \times 3.14$$

$$\approx 12.56$$

$\therefore$ area of sphere can never equal area of cube

END OF PAPER

with r being radius of sphere and length of sides of cube.

