Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3300U50-1

S17-3300U50-1

MATHEMATICS
UNIT 1: NON-CALCULATOR
HIGHER TIER

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	

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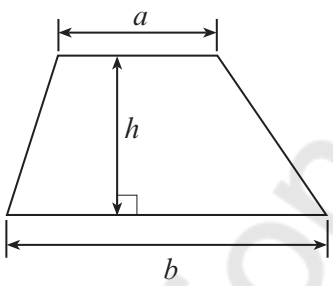
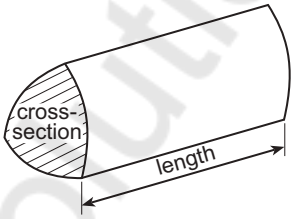
Formula List - Higher Tier

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



Volume of prism = area of cross-section × length

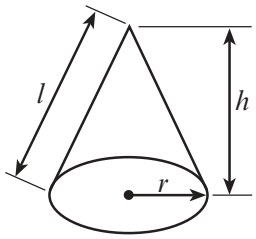


Volume of sphere = $\frac{4}{3}\pi r^3$

Surface area of sphere = $4\pi r^2$

Volume of cone = $\frac{1}{3}\pi r^2 h$

Curved surface area of cone = $\pi r l$

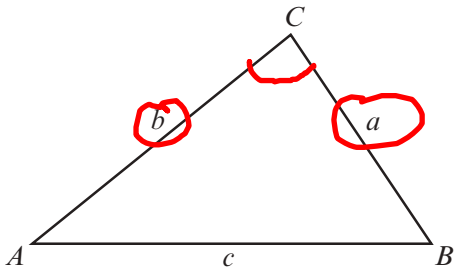


In any triangle ABC

Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$

Area of triangle = $\frac{1}{2}ab\sin C$



The Quadratic Equation

The solutions of $ax^2 + bx + c = 0$ where $a \neq 0$ are given by $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$

Annual Equivalent Rate (AER)

AER, as a decimal, is calculated using the formula $\left(1+\frac{i}{n}\right)^n - 1$, where i is the nominal interest rate per annum as a decimal and n is the number of compounding periods per annum.

Examiner only

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

0·4 + 0·2 0·6 0·4 1

(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]

Pr(E or S) = P(E) + P(S)

Pr(E or S) = 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]

Pr (Both choose North)

Pr (N and N) = P(N) × P(N)

= 0·4 × 0·4

= $\frac{4}{10} \times \frac{4}{10} = \frac{16}{100}$

Pr (Both choose North) = 0·16

3x3

Examiner only

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]

$x = 3$

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

$y = 3^2 - 5\times3 + 2 = 9 - 15 + 2 = -4$

$9 - 15 + 2$

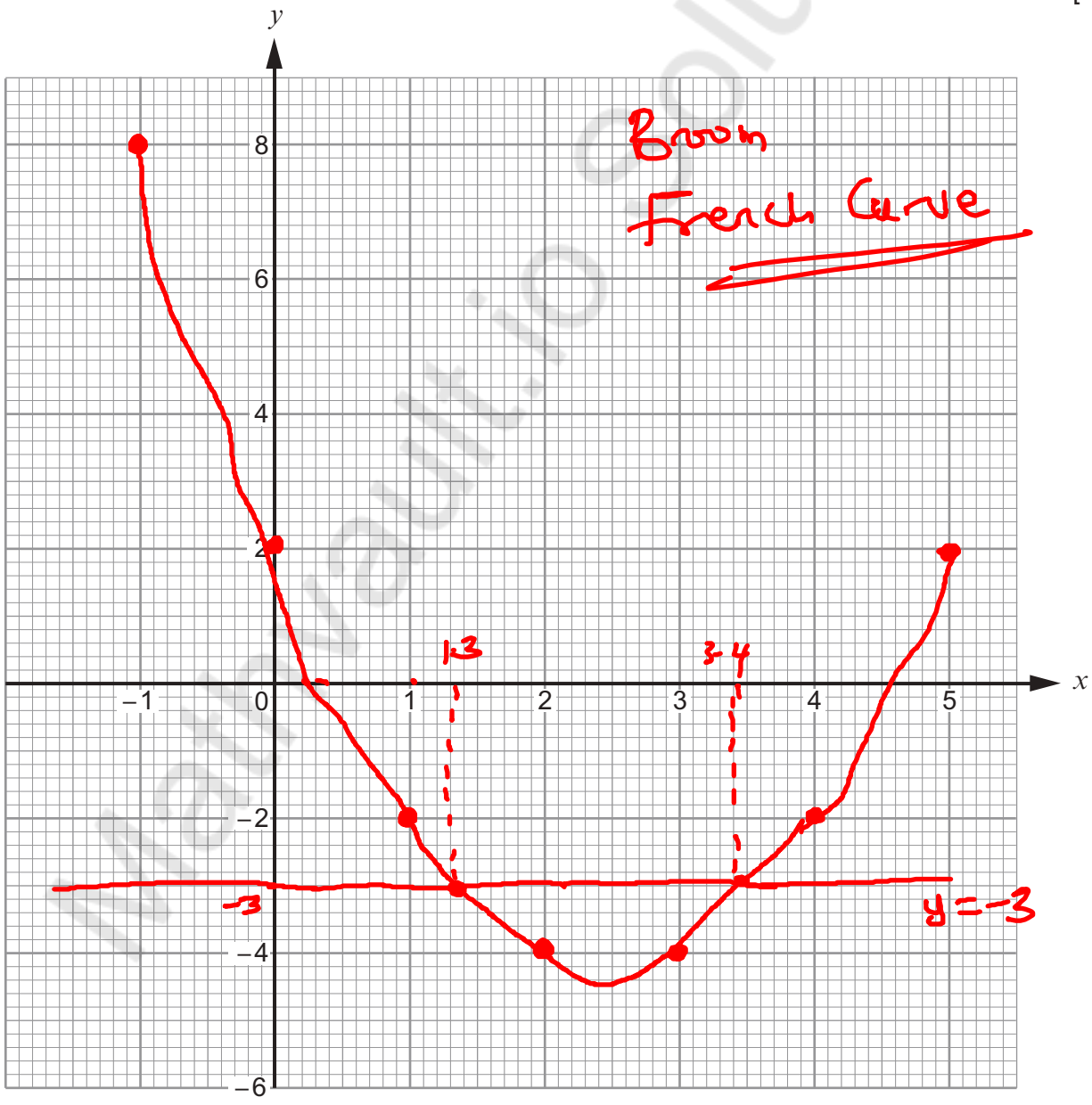
$9 + 2 - 15$

$11 - 15$

$= -4$

$-6 + 2$

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



y=-3

Examiner only

(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 1·3 and 3·4

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

2	700
2	350
5	175
5	35
7	7
	1

175 ÷ 2 = 87 r 1, 15
35 ÷ 5 = 7 r 0, 4
175 ÷ 5 = 35 r 0, 25

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

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

(b) The number 33 554 432 is equal to 2^{25}.

Explain how this tells you that 33 554 432 is not a square number. [1]

* $33554432 = 2^{25}$

2^{25}

So, since the index (25) is not an even number. Then, the number 33554432 is not a square number.

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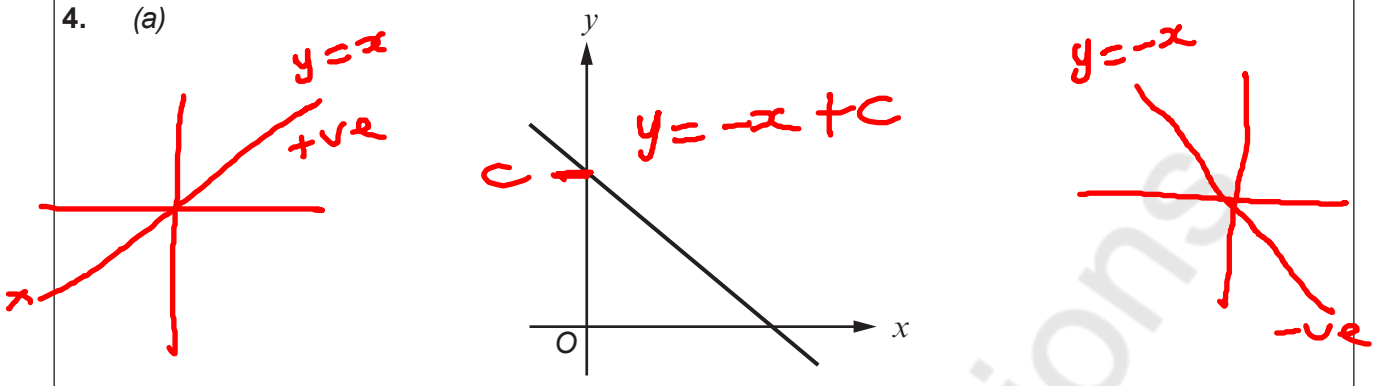
Examiner only

4. *(a)*



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

$y = -x - 2$ $\quad$ $y = -x + 2$ $\quad$ $y = x + 2$ $\quad$ $y = x - 2$ $\quad$ $y = -x$.

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

(2, –5) $\quad$ (5, 2) $\quad$ (–2, 5) $\quad$ (2, 5) $\quad$ (–2, –5)

$2y = 3x + 4$

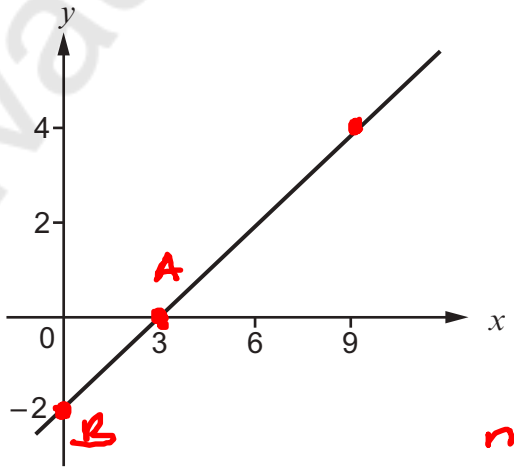
$(2, -5)$: $2x - 5 = 3x2 + 4$, $-10 = 10$ ✗

$(5, 2)$: $2x2 = 3x5 + 4$, $4 = 15$

$(-2, 5)$: $2x5 = 3x-2+4$, $10 = -6 + 4$, $10 = -2$ ✗

$(2, 5)$: $2x5 = 3x2 + 4$, $10 = 10$ ✓

(c)



$A = (3, 0)$ $\quad$ $B = (0, -2)$

$m = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$

$m = \frac{-2 - 0}{0 - 3}$

$m = \frac{-2}{-3} = \frac{2}{3}$

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

$\frac{3}{2}$ $\quad$ $-\frac{3}{2}$ $\quad$ $\frac{2}{3}$ $\quad$ $-\frac{2}{3}$ $\quad$ -6

Examiner only

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]

Let the whole number be x

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

Assume the number is between 1 to 10

$x =$	1	2	3	4	5	6	7	8	9	10
Double $x =$	2	4	6	8	10	12	14	16	18	20

So, the valid answer to clue 1 is that

$x = 4, 5, 6, 7, 8, 9.$

Clue 2: The number x is a prime number

Therefore $x = 5, 7$

The number on the card is 7

Clue 3: The number is not a factor of 100

Since 5 is a factor of 100

The number is 7

Examiner only

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.

The first one has been done for you. [3]

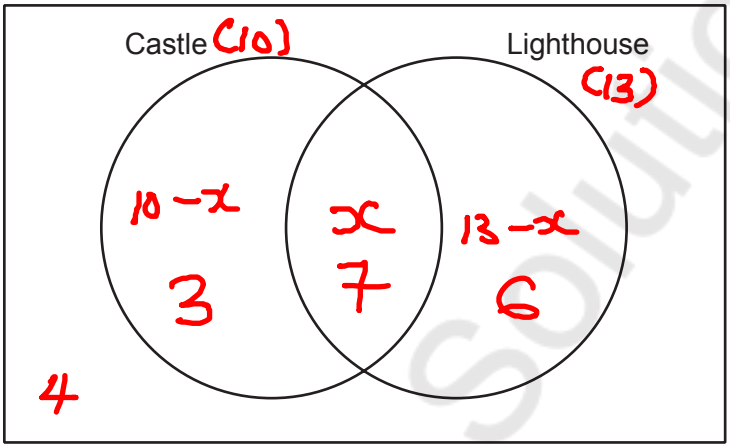
Formula	Formula could be for
$d^3 - 3{\cdot}14r^2h$	volume
$d^2 + hw$	Area
$d + w + h$	Lenght
$2\pi r - \pi r^2$	None of these
$(d + h)w$	Area
$d^3 + dwh$	Volume

Examiner only

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]



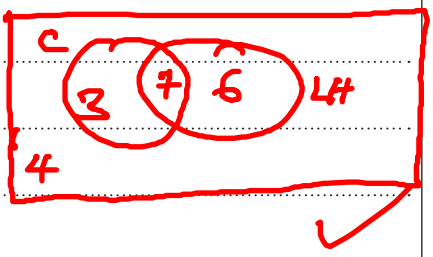
13 − 7 = 6

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

$27 - x = 20$

$27 - 20 = x$

$7 = x$



(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]

Pr (person visited only one place) = Number of people that visit only one place / Total number of people

Pr (Person visited only one place) = $\frac{9}{20}$

Examiner only

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

$$3x + 4y = 7$$
$$2x - 3y = 16$$

Using elimination method: Eliminating x

$3x + 4y = 7 \quad \times 2$

$2x - 3y = 16 \quad \times 3$

$6x + 8y = 14$

$-\ 6x - 9y = 48$

$0 + 17y = -34$

$\frac{17y}{17} = \frac{-34}{17}$

$y = -2$

From equation (1) $2x - 3y = 16$

$2x - 3(-2) = 16$

$2x + 6 = 16$

$-6 \quad -6$

$\frac{2x}{2} = \frac{10}{2}$

$x = 5$

$x = 5$ and $y = -2$

$(5, -2)$

Examiner only

9. Calculate the value of $(5{\cdot}41 \times 10^5) + (2{\cdot}3 \times 10^4)$.
Give your answer in standard form. [2]

$5{\cdot}41 \times 10^5 + 2{\cdot}3 \times 10^4$

$5{\cdot}41 \times 10^5 + 2{\cdot}3 \times \frac{10^5}{10}$

$5{\cdot}41 \times 10^5 + 0{\cdot}23 \times 10^5$

$10^5(5{\cdot}41 + 0{\cdot}23)$

$10^4 = \frac{10^5}{10}$

$10^5 \times 5{\cdot}64$

$5{\cdot}64 \times 10^5$

5·41
0·23
5·64

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.

Rashid buys 17 extra sheep.
Eifion sells 8 of his sheep.

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]

Total sheep owned by Rashid = n

Eifion had 4 times of Rashid sheep = $4 \times n = 4n$

Now, Rashid bought extra 17 sheep

So, new Rashid sheep = $n + 17$

Eifion sold 8 sheep

So, new Eifion sheep = $4n - 8$

Eifion sheep > Rashid sheep

$4n - 8 > n + 17$

$-n \quad +8 \qquad -n \quad +8$

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

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

Least value of $n = 9$

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$a^{\frac{1}{n}} = \sqrt[n]{a}$ $\quad a^{-n} = \frac{1}{a^n}$

Examiner only

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

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

(b) Express $0\cdot3\dot{7}\dot{2}$ as a fraction. [2]

$0\cdot3\overline{72} = 0\cdot37272727\overline{72}$

Let $x = 0\cdot37272727\overline{72}$

So, $10x = 3\cdot72727272\overline{72}$

$1000x = 372\cdot72727272\overline{72}$

$-\ 10x = 3\cdot72727272\overline{72}$

$990x = 369\cdot000000$

$990x = 369$

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

$x = \frac{123}{330} = \frac{41}{110}$

$0\cdot3\overline{72} = \frac{41}{110}$ //

(c) Find the value of $\left(\sqrt{63} - \sqrt{7}\right)^2$. [3]

$(\sqrt{63} - \sqrt{7})^2 = (\sqrt{63} - \sqrt{7})(\sqrt{63} - \sqrt{7})$

$\sqrt{63}[\sqrt{63} - \sqrt{7}] - \sqrt{7}[\sqrt{63} - \sqrt{7}]$

$\sqrt{63\times63} - \sqrt{63\times7} - \sqrt{63\times7} + \sqrt{7\times7}$

$63 - \sqrt{9\times7\times7} - \sqrt{9\times7\times7} + 7$

$63 - \sqrt{3\times3\times7\times7} - \sqrt{3\times3\times7\times7} + 7$

$63 - \sqrt{21\times21} - \sqrt{21\times21} + 7$

$63 - 21 - 21 + 7$

$63 + 7 - 42$

$70 - 42$

$= 28$

Examiner only

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

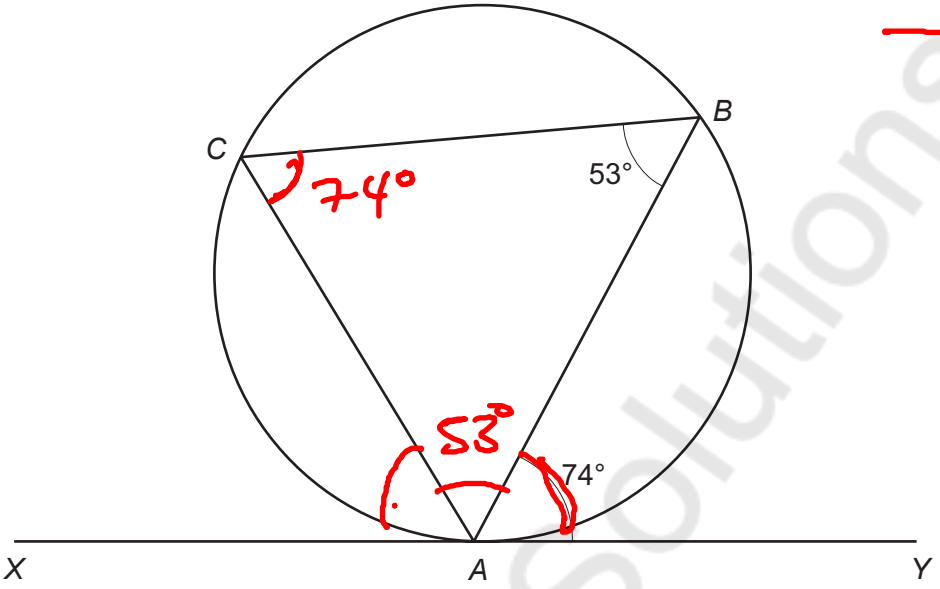


Diagram not drawn to scale

$B\hat{A}Y = 74°$ and $A\hat{B}C = 53°$.
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]

An isosceles triangle is a triangle that has either two of its sides equal and two of its angle equal

$\angle BAY = \angle ACB$

$\angle ACB = \angle BAY = 74°$ [Alternate segment theorem]

Sum of angle in a triangle is 180°

$\angle A + \angle B + \angle C = 180$

$\angle A = 180 - \angle B - \angle C = 180 - 53 - 74$

$\angle A = 53°$

Since, two angle of the triangle ABC are equal i.e 53°. Then ΔABC is an isosceles triangle.

Examiner only

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

$$x + y \leqslant 6$$

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

$$x \geqslant -2.$$

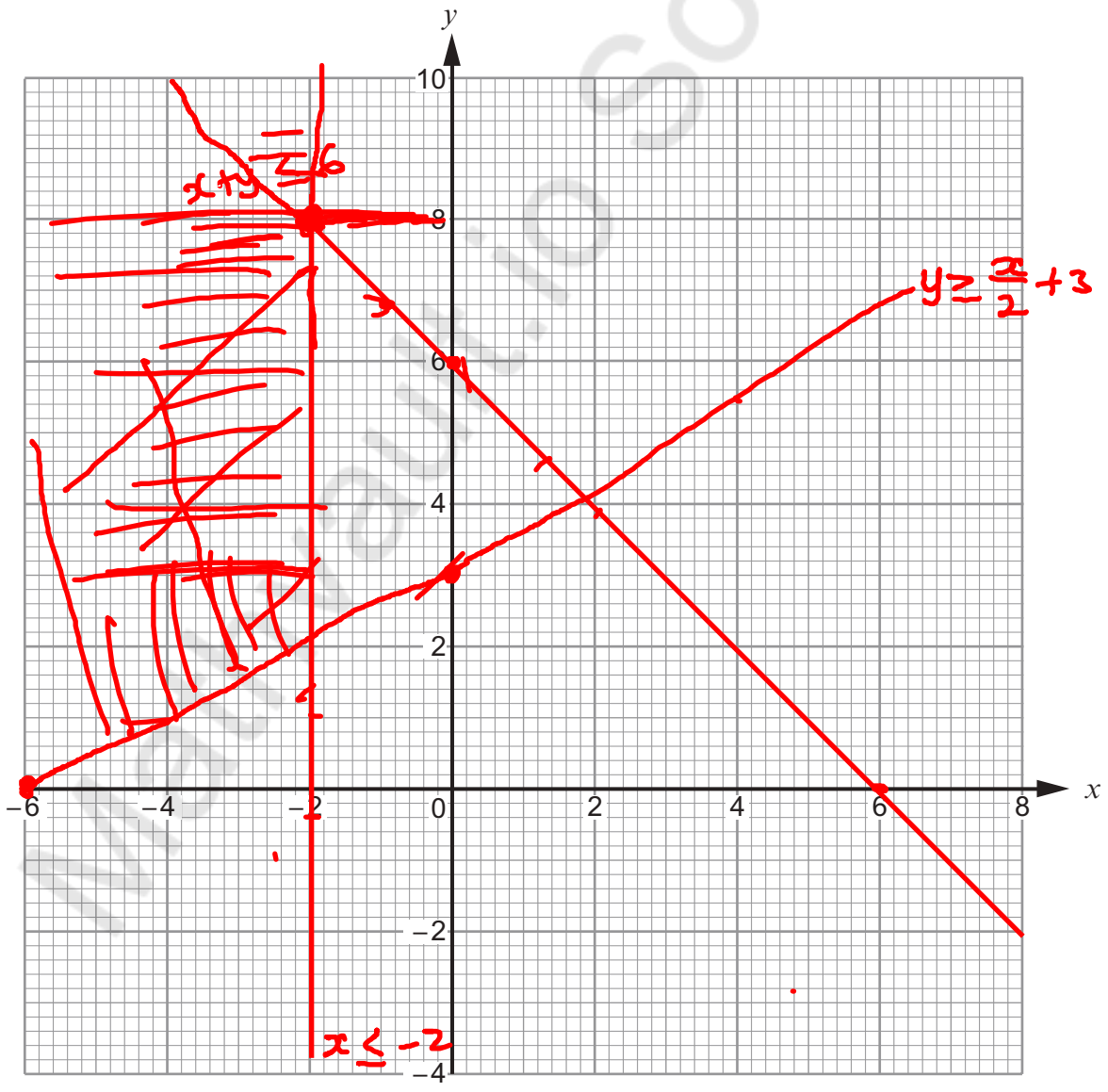
Clearly indicate the region that represents your answer. [3]

$x+y \leq 6$ | $y \geq \frac{x}{2}+3$ | $x \geq -2$

$x=0 \quad y=6$ | $x=0 \quad y=3$ | $x \geq -2$

$y=0 \quad x=6$ | $y=0 \quad x=-6$ | $x=2$

$x+y=6$



Examiner only

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

x = ... −2 .....

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

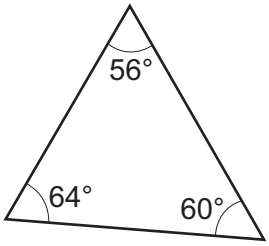
y = ... 8 .....

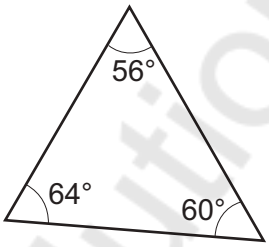
Examiner only

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

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

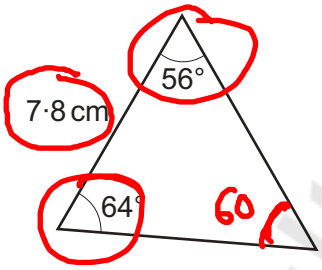
(a) [1]

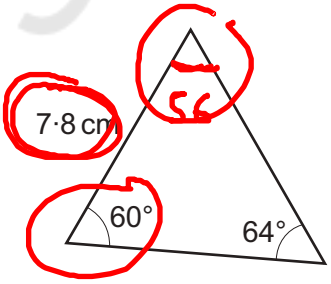




congruent: SSS | congruent: SAS | congruent: ASA | congruent: RHS | definitely not congruent | not necessarily congruent

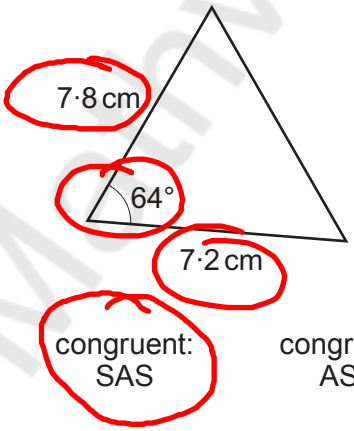
(b) [1]

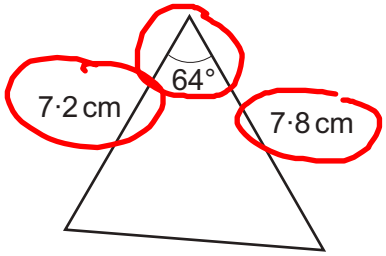




congruent: SSS | congruent: SAS | congruent: ASA | congruent: RHS | definitely not congruent | not necessarily congruent

(c) [1]

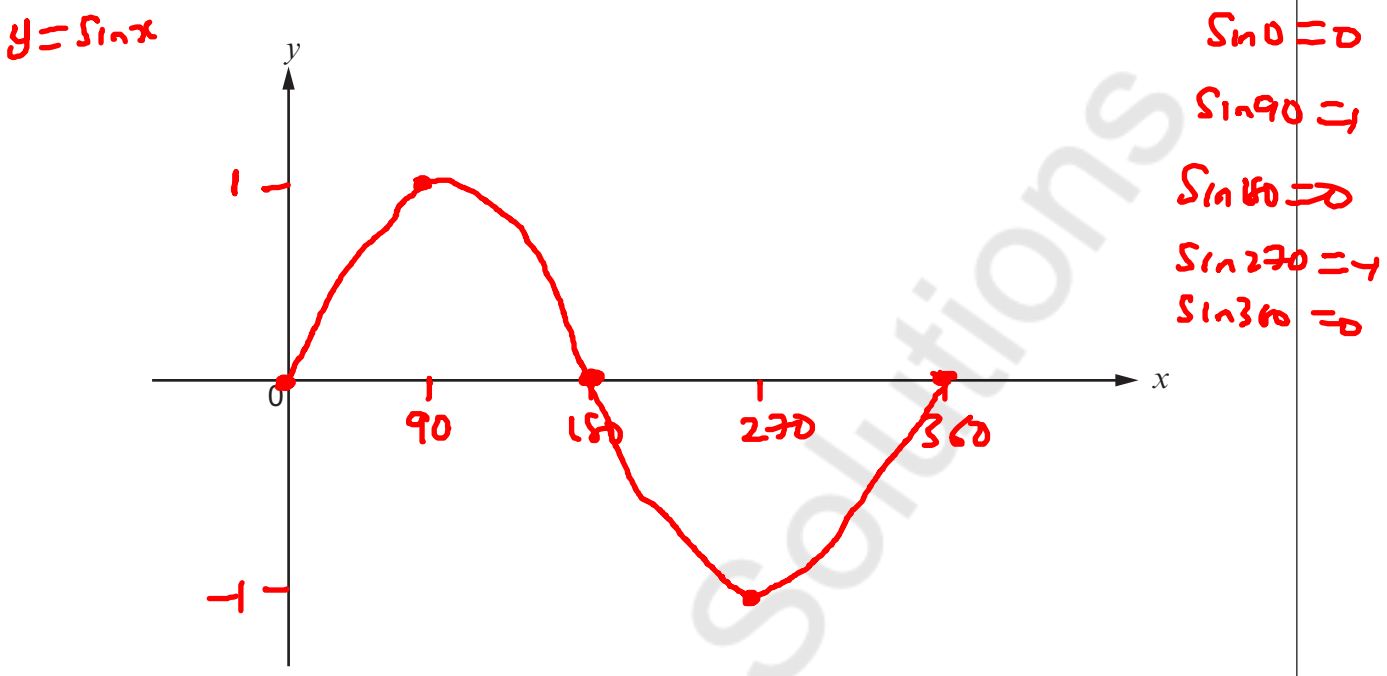




congruent: SSS | congruent: SAS | congruent: ASA | congruent: RHS | definitely not congruent | not necessarily congruent

Examiner only

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°. [1]

sin 20° sin 100° sin 160° sin 220° sin 340°

* $\sin(180 - \theta) = \sin\theta$

$\sin\theta = \sin(180 - \theta)$

$\sin 200 = \sin(180 - 200)$

$\sin 200 = \sin(-20)$

* $\sin\theta = \sin(\theta + 360)$

$\sin(-20) = \sin(-20 + 360)$

$= \sin 340$

$\sin 200 = \sin(-20) = \sin 340$

Examiner only

16. The diagram shows two rectangles.

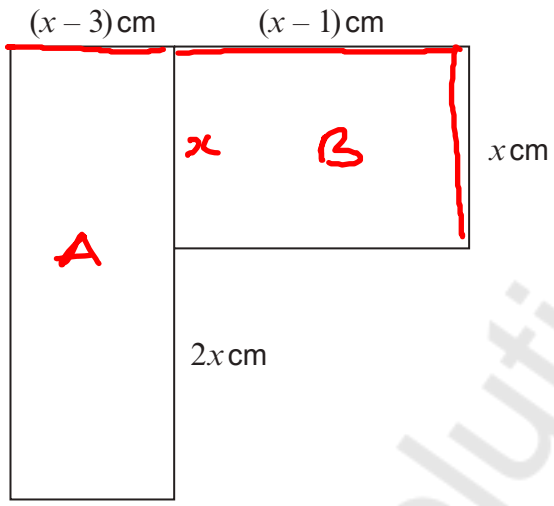


Diagram not drawn to scale

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]

Area A + Area B = 50 cm²

$L_A \times W_A + L_B \times W_B = 50$

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

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

$\frac{4x^2}{2} - \frac{10x}{2} = \frac{50}{2}$

$2x^2 - 5x = 25$

$2x^2 - 5x - 25 = 0$ proved

$ax^2+bx+c=0$

Quadratic equation

$x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

$a=2 \quad b=-5 \quad c=-25$

$x = \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 2 \times -25}}{2 \times 2}$

$x = \frac{5 \pm \sqrt{25+200}}{4}$

$x = \frac{5 \pm \sqrt{225}}{4}$

$x = \frac{5 \pm 15}{4}$

$x = \frac{5+15}{4}$ or $\frac{5-15}{4}$

$x = \frac{20}{4}$ or $\frac{-10}{4}$

$x = 5$ or -2.5

15
15
75
1
15
225

$x = 5$ //

Examiner only

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]

R → 6 G → 4 Y → 2 Total Block = 12

P(R n G n Y)

P(R) × P(G) × P(Y)

$\frac{6^1}{12_2} \times \frac{4}{11} \times \frac{2^1}{10_5} = \frac{2}{55}$ //

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

P(RRR) + P(GGG) + P(YYY)

$\frac{6}{12_2} \times \frac{5}{11} \times \frac{4^{2\,1}}{10_5} + \frac{4^{2\,1}}{12_6} \times \frac{3}{11} \times \frac{2}{10_5} + \frac{2}{12} \times \frac{1}{11} \times \frac{0}{1} \to 0$

$\frac{1 \times 5}{11 \times 5} + \frac{1}{55}$

$\frac{5}{55} + \frac{1}{55} = \frac{6}{55}$

R G Y

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

P(RGY) + P(RYG) + P(YRG) + P(YGR) + P(GYR) + P(GRY)

P(same colour) + P(not same colour) = 1

P(not same colour) = 1 − P(same col)

P(not same colour) = $1 - \frac{6}{55}$

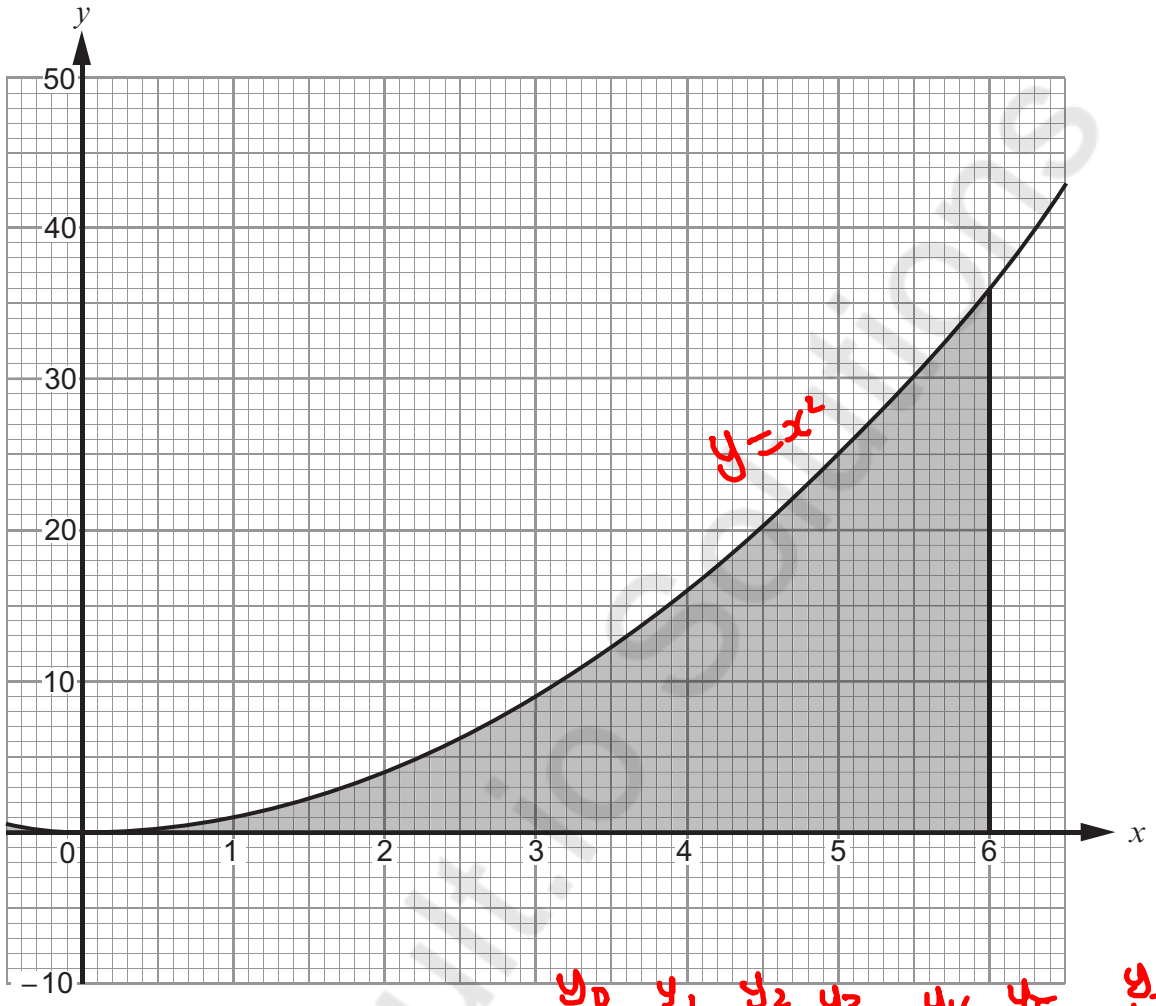
$= \frac{55 - 6}{55}$

$= \frac{49}{55}$ //

4 1 5 5 / 4 9

Examiner only

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



y_0 y_1 y_2 y_3 y_4 y_5 y_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. [4]

Trapezium Rule

Area $= \frac{h}{2} \times [y_0 + y_n + 2(y_1 + y_2 + y_3 + y_4 + \ldots + y_{n-1})]$

Area $= \frac{h}{2} \times [y_0 + y_6 + 2[y_1 + y_2 + y_3 + y_4 + y_5]]$

$y = x^2$ $y_0 = 0^2 = 0$ $y_1 = 1^2 = 1$ $y_2 = 2^2 = 4$

$y_3 = 3^2 = 9$ $y_4 = 4^2 = 16$ $y_5 = 5^2 = 25$

$y_6 = 6^2 = 36$ $h = 1$

110
36
146

Area $= \frac{1}{2}[0 + 36 + 2(1 + 4 + 9 + 16 + 25)]$

50

Area $= \frac{1}{2}[36 + 110) = \frac{1}{2} \times 146 = 73$

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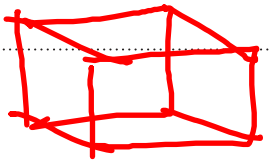
19. By considering algebraic expressions, show that it will never be possible for the surface area of a sphere of radius r to be equal to the surface area of a cube with sides of length r. [2]

Surface area of a sphere is $4\pi r^2$

Surface Area of a Cube

$4\pi r^2 \neq 6r^2$

r^2 r^2



Area of one face $= r^2$

Surface Area of a cube $= 6 \times r^2$

$= 6r^2$

END OF PAPER

$4\pi \neq 6$

3.

Since $\pi = 3.14$

$4 \times 3.14 \neq 6$

$12.56 \neq 6$

3.14
× 4
12.56

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