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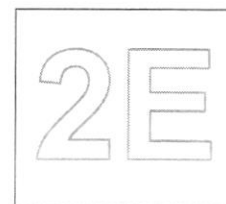
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## 2022 End of Year Examination

### Secondary Two Express

#### MATHEMATICS

Paper 1

10 Oct 2022

1 hour 15 minutes

0800h – 0915h

Name: \_\_\_\_\_ (     )     Class: \_\_\_\_\_

#### READ THESE INSTRUCTIONS FIRST

Write your full name, class and index number on all work you hand in.

Write in dark blue or black pen.

You may use a pencil for any diagrams or graphs.

Do not use staples, paper clips, glue or correction fluid.

Answer **all** questions.

If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

If the degree of accuracy is not specified in the question, and if the answer is not exact, give the answer to three significant figures. Give answers in degrees to one decimal place.

For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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

The total number of marks for this paper is 50.

FOR MARKER'S USE		
	Marks Awarded	Max Marks
Total		50

This question paper consists of **13** printed pages including the cover page.

**Setter: Mrs Irving Long**

***Mathematical Formulae****Mensuration*

Curved Surface area of a cone =  $\pi r l$

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

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

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

Answer all questions.

- 1 Solve the following simultaneous equations.

$$x - 2y = 13$$

$$2x + y = 6$$

*Answer*  $x = \dots\dots\dots$

$y = \dots\dots\dots$  [3]

- 2 2 workers can paint a school in 9 days.  
6 workers are employed to paint the school.  
After working for two days, 2 of the workers are ill and the rest of the workers continue to paint the school.

- (a) Find the total number of days taken to paint the school.

*Answer*  $\dots\dots\dots$  [3]

- (b) State one assumption that we make for (a).

*Answer*  $\dots\dots\dots$

$\dots\dots\dots$  [1]

3 Expand  $(x-2)(3-x)$ .

*Answer* ..... [2]

---

4 Factorise the following expressions completely.

(a)  $25-15y$ .

*Answer* ..... [1]

(b)  $2x^2-4x-6$ .

*Answer* ..... [2]

(c)  $2ax - 3ay - 4bx + 6by$ .

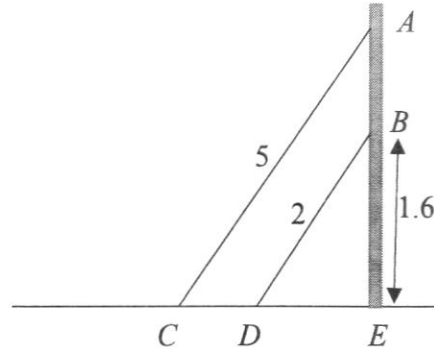
*Answer* ..... [2]

---

5 Given that  $p + 2q = -2$  and  $pq = -18$ , find the value of  $(p - 2q)^2$ .

*Answer* ..... [3]

- 6 In the diagram,  $AC$  and  $BD$  represent two ladders leaning against a vertical wall  $ABE$ .  $CDE$  represents the horizontal ground. Triangles  $ACE$  and  $BDE$  are similar. Given that  $B$  is 1.6 m above the ground, what is the length of  $AB$ ?



Answer .....m [3]

7 Simplify the following expressions.

(a)  $\frac{7}{x-3} - \frac{3}{3-x}$ .

Answer ..... [2]

(b)  $\frac{6x^2y}{4y^3} \div \frac{12x^3}{16xy}$ .

Answer ..... [1]

(c)  $\frac{16x^2-9}{4x^2-9x-9}$ .

Answer ..... [3]

8 Solve  $\frac{4+a}{5} = \frac{a-2}{3}$ .

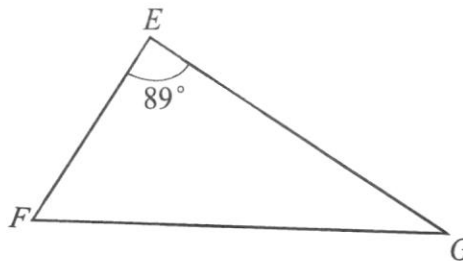
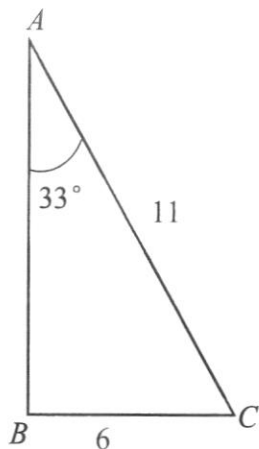
Answer  $a =$  ..... [2]

- 9 Given that  $c = \frac{8b+3}{b+1}$ , make  $b$  the subject of formulae.

*Answer* ..... [3]

- 10 Triangle  $ABC$  and Triangle  $GEF$  are congruent.

It is given that  $AC = 11$  cm,  $BC = 6$  cm, angle  $FEG = 89^\circ$  and angle  $BAC = 33^\circ$ .



- (a) State the corresponding angle of  $\angle BAC$ .

Answer  $\angle$  ..... [1]

- (b) Find the length of  $FG$ .

Answer ..... cm [1]

- (c) Find angle  $EFG$ .

Answer .....  $^\circ$  [1]

- 11** The scale of map  $A$  is 1 : 200 000.  
The scale of map  $B$  is 1 : 50 000.

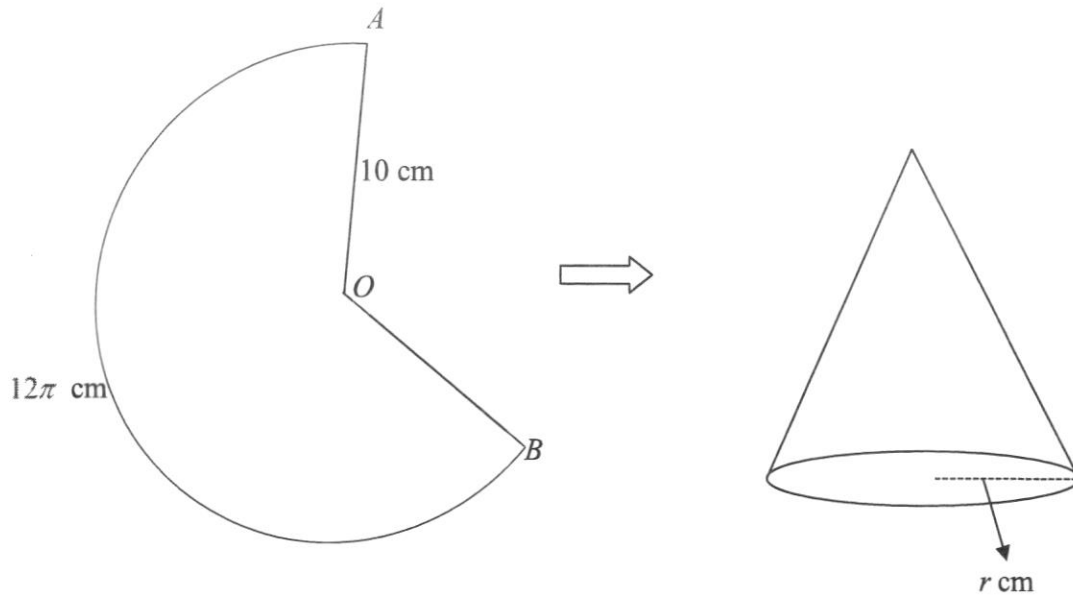
- (a) The distance between two parks on map  $A$  is 4 cm.  
Find the distance between the two parks in centimetres on map  $B$ .

*Answer* .....cm [2]

- (b) A school is represented by a rectangle of sides 5cm by 10 cm on map  $B$ .  
Find the area of the school on map  $A$  in  $\text{cm}^2$ .

*Answer* ..... $\text{cm}^2$  [2]

- 12 A sector  $AOB$  of radius 10 cm and arc length of  $12\pi$  cm is folded into a cone of base radius  $r$  cm such that  $OA$  just meet  $OB$ .



- (a) Show that the base radius of the cone,  $r$ , is 6 cm.

[2]

- (b) Find the curved surface area of the cone.

Answer .....  $\text{cm}^2$  [2]

**13** Mary has three 10-cent coins, six 20-cent coins, one 50-cent coin and 5 \$1 coins in her pocket.

**(a)** Find the probability that a coin chosen at random is worth \$1.

Leave your answer as a fraction in its lowest term.

*Answer* ..... [1]

**(b)** Some of the 20-cent coins are removed.

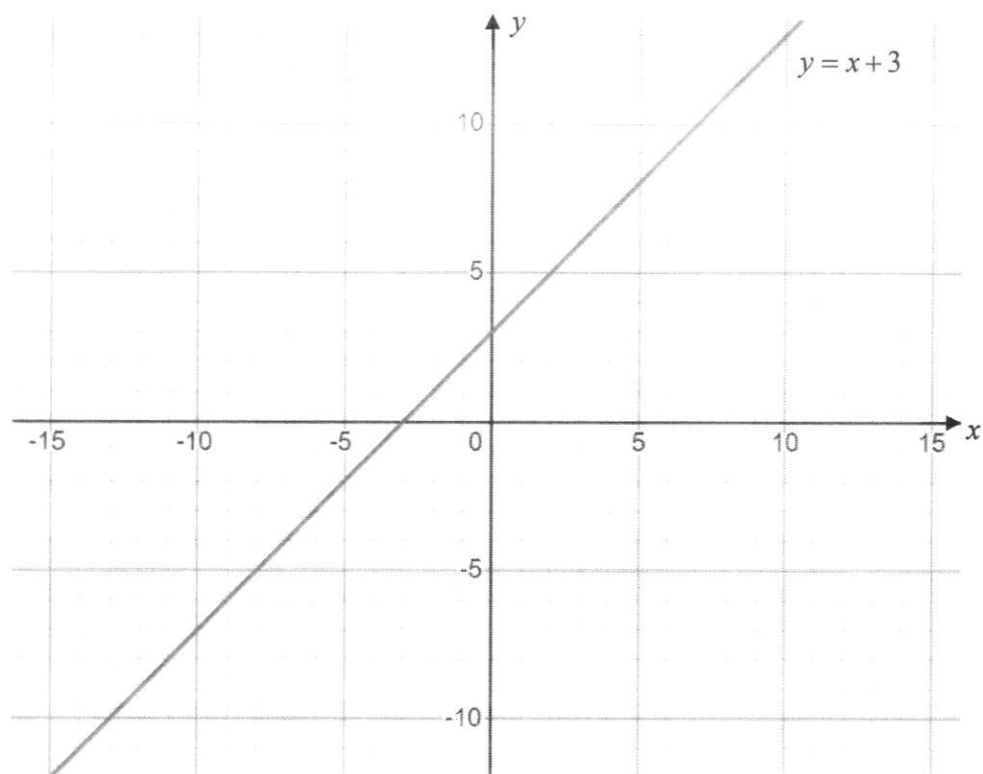
The probability of picking a 20-cent coin from the remaining coins in Mary's pocket

is now  $\frac{4}{13}$ .

Find the number of coins that were removed.

*Answer* ..... [2]

- 14 The graph of  $y = x + 3$  is shown below.



- (a) The point  $(t, 4)$  lies on  $y = x + 3$ .

Use the graph above to find the value of  $t$ .

Answer  $t = \dots\dots\dots$  [1]

- (b) Complete the table of values for the linear function  $7x + 6y + 48 = 0$ .

$x$	-12	-6	0	3
$y$	6	-1		-11.5

[1]

- (c) Plot the graph of  $7x + 6y + 48 = 0$  on the same grid above.

[1]

- (d) Hence, **use the graph** to solve the simultaneous equations

$$y = x + 3 \text{ and } 7x + 6y + 48 = 0.$$

Answer  $x = \dots\dots\dots$   $y = \dots\dots\dots$  [2]

**End of Paper**



## 2022 End of Year Examination

### Secondary Two Express

#### MATHEMATICS

Paper 2

13 Oct 2022

1 hour 15 minutes

0800h – 0915h

Name: \_\_\_\_\_ (     )     Class: \_\_\_\_\_

#### READ THESE INSTRUCTIONS FIRST

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Do not use staples, paper clips, glue or correction fluid.

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If working is needed for any question it must be shown with the answer.

Omission of essential working will result in loss of marks.

The use of an approved scientific calculator is expected, where appropriate.

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For  $\pi$ , use either your calculator value or 3.142, unless the question requires the answer in terms of  $\pi$ .

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

The total number of marks for this paper is 50.

FOR MARKER'S USE		
	Marks Awarded	Max Marks
Total		50

This question paper consists of 12 printed pages including the cover page.

Setter: Ms Diyanah

***Mathematical Formulae****Mensuration*

$$\text{Curved Surface area of a cone} = \pi r l$$

$$\text{Surface area of a sphere} = 4\pi r^2$$

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

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

Answer **all** the questions.

1 Simplify  $\frac{2d+6}{8d^2-72}$ .

Answer \_\_\_\_\_ [2]

---

2 Express  $\frac{1}{4a^2b} - \frac{1}{12ab^3}$  in its simplest form.

Answer \_\_\_\_\_ [2]

---

3 Find the smallest integer  $x$  that satisfies the inequality  $\frac{7}{2}(x+3) > 3x+4$ .

Answer \_\_\_\_\_ [3]

- 4 The table below shows the number of hours a group of students spent surfing the internet in a day.

No. of hours	0	1	2	3	4
No. of students	2	3	4	$x$	0

- (a) If the mode is 2, write down the largest possible value of  $x$ .

*Answer* \_\_\_\_\_ [1]

- (b) If the median is 2, write down the smallest possible value of  $x$ .

*Answer* \_\_\_\_\_ [1]

- 5 The force of attraction,  $F$  newtons, between two magnets is inversely proportional to the square of the distance,  $x$  cm, between them.  
When the magnets are 10 cm apart, the force is 5 newtons.

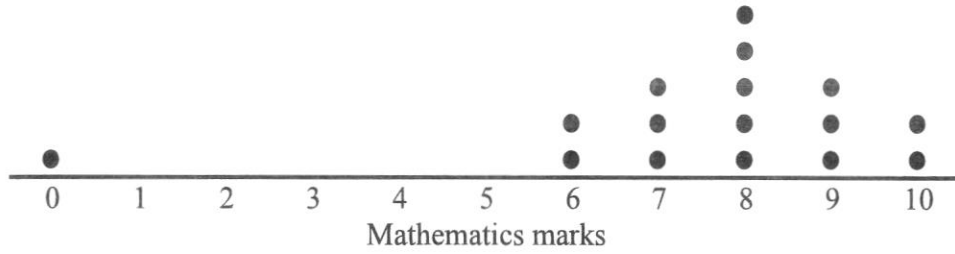
- (a) Write down a formula connecting  $F$  and  $x$ .

*Answer* \_\_\_\_\_ [2]

- (b) Find the force of attraction when the magnets are 2.2 cm apart.

*Answer* \_\_\_\_\_ Newtons [1]

- 6 The dot diagram shows the marks of a Mathematics quiz achieved by 16 students in a class. The total marks for the quiz is 10.



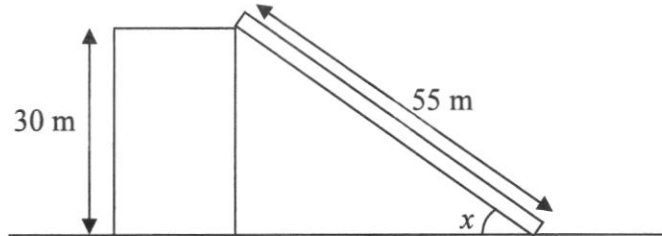
- (a) Calculate the mean mark.

*Answer* \_\_\_\_\_ [1]

- (b) Do you think the mean mark in (a) reflects accurately on the average marks achieved by the class? Explain your answer.

*Answer* \_\_\_\_\_  
 \_\_\_\_\_ [1]

- 7 A fireman raised a ladder to the top of the building to rescue victims on the rooftop of the building. The ladder is 55 m long and the building is 30 m tall.



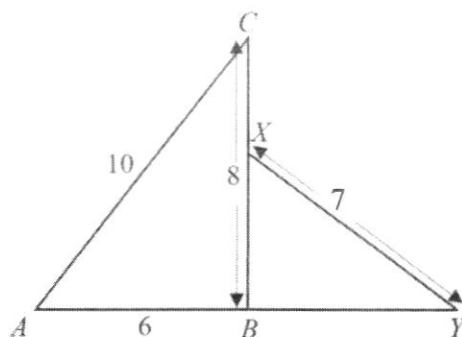
- (a) How far away is the foot of the ladder from the building?

*Answer* \_\_\_\_\_ m [2]

- (b) Find  $\angle x$ .

*Answer* \_\_\_\_\_ ° [2]

- 8 The figure shows two triangles joined together.  
Given that  $ABY$  is a straight line,  $AB = 6$  cm,  $BC = 8$  cm,  $AC = 10$  cm and  $XY = 7$  cm.



- (a) Show that  $\triangle ABC$  is a right-angled triangle.

*Answer* \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_ [1]

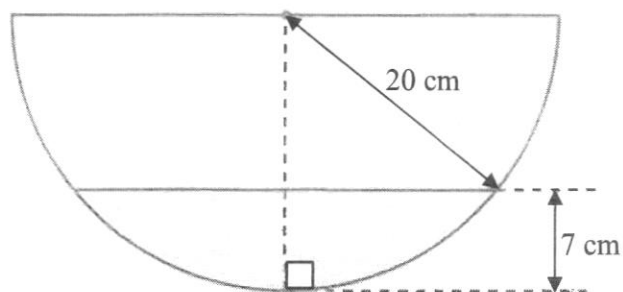
- (b) Express  $\tan \angle CAB$  as a fraction.

*Answer* \_\_\_\_\_ [1]

- (c) If  $\sin \angle XYB = \frac{3}{4}$ , find the length of  $XC$ .

*Answer* \_\_\_\_\_ cm [2]

9



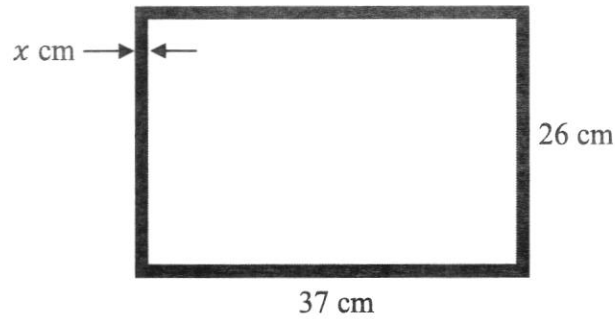
The diagram shows the cross-section of a hemispherical bowl of radius 20 cm.

Water is poured into the bowl to a depth of 7 cm.

Find the area of the surface of the water.

Answer \_\_\_\_\_ cm<sup>2</sup> [3]

- 10** A rectangular photo frame has a dimension of 37 cm by 26 cm.  
The frame has a border with uniform thickness of  $x$  cm, such that the photo within the frame has an area of  $726 \text{ cm}^2$ .



- (a) Write down an expression, in terms of  $x$ , for the
- (i) length of the photo, *Answer* \_\_\_\_\_ cm [1]
- (ii) width of the photo. *Answer* \_\_\_\_\_ cm [1]
- (b) Form an equation in  $x$  and show that it reduces to  $2x^2 - 63x + 118 = 0$ . [2]

- (c) Solve the equation  $2x^2 - 63x + 118 = 0$  to find the thickness of the border.

*Answer*  $x =$  \_\_\_\_\_ [2]

- 11 The test marks of 20 Secondary Two students in a class are shown in the table and stem-and-leaf diagram below.

The passing mark for this test is 50.

46	56	86	50	56
76	68	66	72	74
69	74	42	73	76
64	86	40	48	70

Stem	Leaf
4	0 2 6 8
5	0 6 6
6	$a$ 6 8 9
7	0 2 3 4 4 6 6
8	6 6

Key: 4|0 represents 40 marks

- (a) Find the value of  $a$ .

Answer  $a =$  \_\_\_\_\_ [1]

- (b) Find the fraction of students who obtained more than 65 marks.

Answer \_\_\_\_\_ [1]

- (c) If 180 Secondary Two students test scores are to be recorded, is it suitable to represent the data using a stem-and-leaf diagram? Explain your answer.

Answer \_\_\_\_\_  
 \_\_\_\_\_ [1]

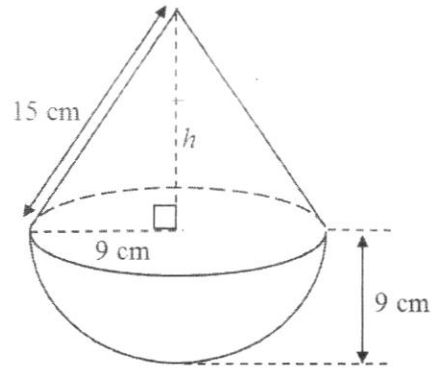
- (d) Given that 40% of the students did not qualify to take Additional Mathematics (AM) in the following year, find the least score needed for a student to qualify to take AM.

Answer \_\_\_\_\_ marks [2]

- (e) Based on the test results, Jenny said that the test is easy. Do you agree? Justify your answer.

Answer \_\_\_\_\_  
 \_\_\_\_\_ [1]

- 12 The diagram shows a solid made from a cone and a hemisphere.



- (a) Show that the height,  $h$ , of the cone is 12 cm. [1]

- (b) Calculate the volume of the solid.

Answer \_\_\_\_\_  $\text{cm}^3$  [2]

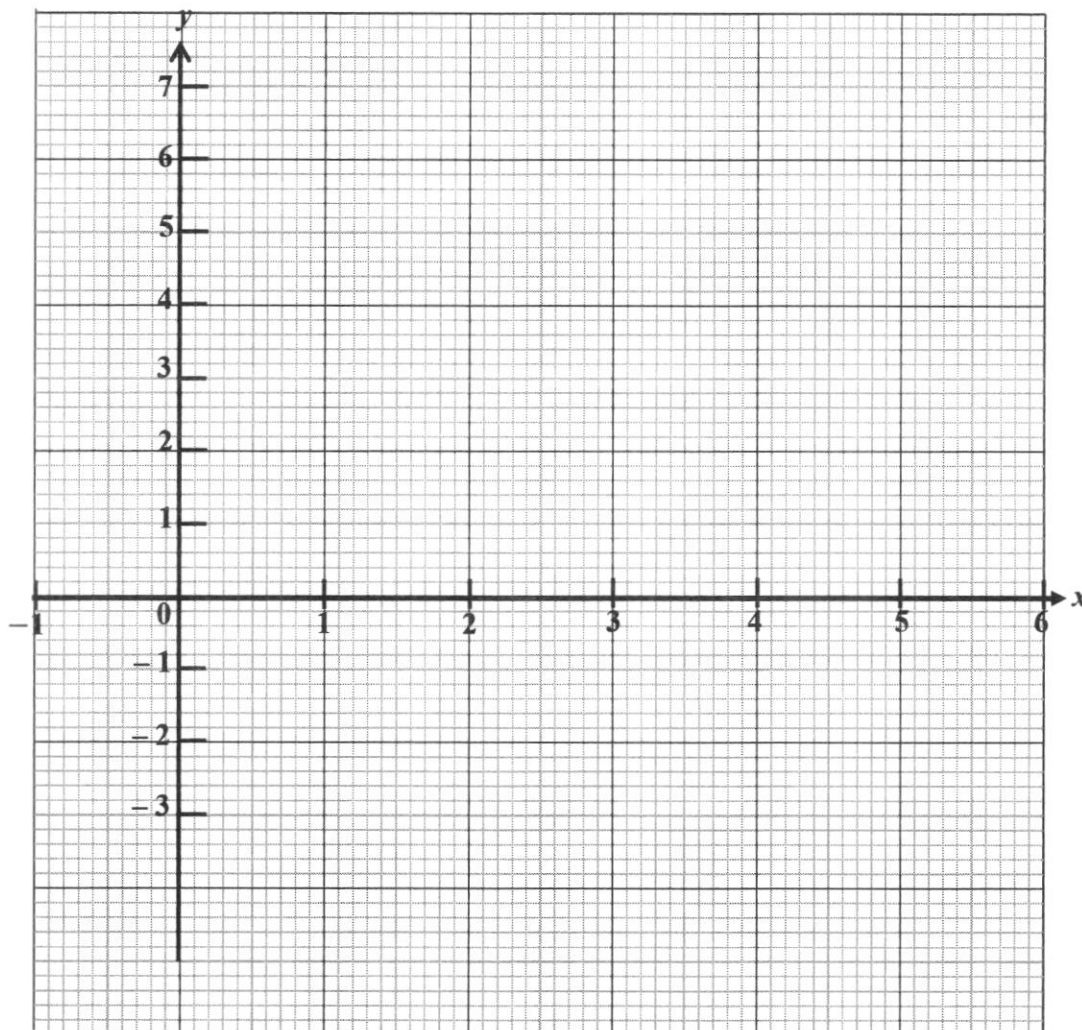
- (c) Calculate the total surface area of the solid.

Answer \_\_\_\_\_  $\text{cm}^2$  [3]

- 13 (a) Complete the table of values for  $y = -x^2 + 6x - 3$ . [1]

$x$	0	1	2	3	4	5	6
$y$		2	5		5	2	-3

- (b) Draw the graph of  $y = -x^2 + 6x - 3$  on the axis below. [2]



- (c) Use your graph to find  
(i) the values of  $x$  when  $y = 3$ ,

Answer  $x = \underline{\hspace{2cm}}$  or  $x = \underline{\hspace{2cm}}$  [2]

(ii) the equation of line of symmetry,

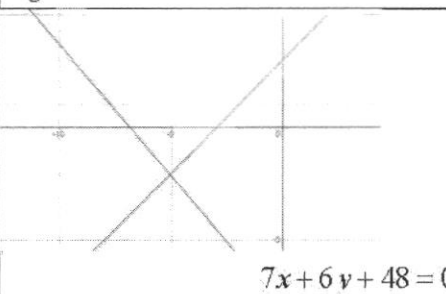
*Answer* \_\_\_\_\_ [1]

(iii) the  $y$ -intercept.

*Answer* \_\_\_\_\_ [1]

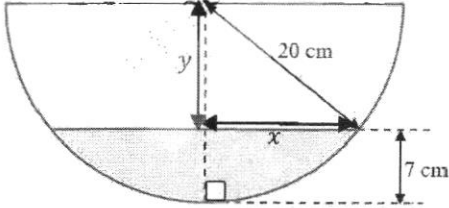
**End of paper**

## 2022 EOY Sec 2E EM P1 Answers

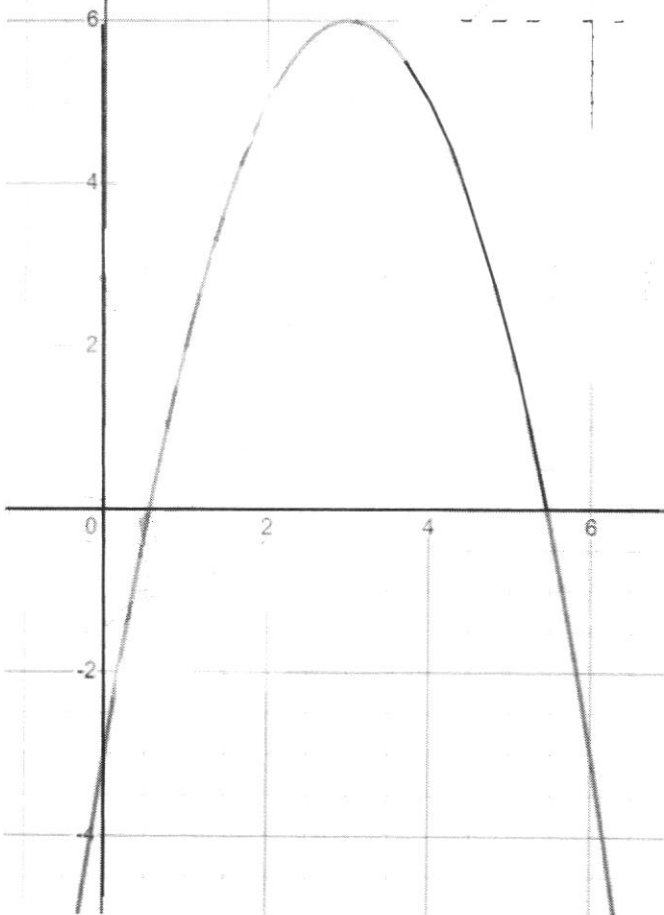
Qns	Suggested Solution
1	$y = -4, x = 5$
2a	3.5 days
b	The workers work at the same rate.
3	$-x^2 + 5x - 6$
4a	$25 - 15y = 5(5 - 3y)$
b	$2(x - 3)(x + 1)$
c	$(2x - 3y)(a - 2b)$
5	$(p - 2q)^2 = 148$
6	$AB = 2.4 \text{ m}$
7a	$\frac{10}{x-3}$
b	$\frac{2}{y}$
c	$\frac{4x-3}{x-3}$
8	$a = 11$
9	$b = \frac{c-3}{8-c}$
10a	$EGF$
b	11 cm
c	$58^\circ$
11a	16 cm
b	$3.125 \text{ cm}^2$
12a	6
b	$188 \text{ cm}^2$
13a	$\frac{5}{15} = \frac{1}{3}$
b	$x = 2$
14a	$t \geq 1$
b	-8
c	 <p style="text-align: center;"><math>7x + 6y + 48 = 0</math></p>
d	$x = -5, y = -2$

**MARKING SCHEME**  
**2E MATHS PAPER 2 2022**

Qn	Solution	Marks	Remarks
1	$\frac{2d+6}{8d^2-72}$ $= \frac{2(d+3)}{8(d-3)(d+3)}$ $= \frac{1}{4(d-3)}$	M1 A1	
2	$\frac{1}{4a^2b} - \frac{1}{12ab^3}$ $= \frac{3b^2}{12a^2b^3} - \frac{a}{12a^2b^3}$ $= \frac{3b^2 - a}{12a^2b^3}$	M1 A1	
3	$\frac{7}{2}x + \frac{21}{2} > 3x + 4 \quad \text{OR} \quad 7(x+3) > 6x + 8$ $\frac{1}{2}x > -\frac{13}{2} \quad \quad \quad 7x + 21 > 6x + 8$ $x > -13 \quad \quad \quad x > -13$ $\therefore x = -12$	M1 M1 A1	
4(a)	3	B1	
4(b)	2	B1	
5(a)	$5 = \frac{k}{10^2}$ $k = 500$ $\therefore F = \frac{500}{x^2}$	M1 A1	
5(b)	$F = \frac{500}{2.2^2}$ $= 103 \text{ Newtons}$	B1	
6(a)	$\frac{(0 \times 1) + (6 \times 2) + (7 \times 3) + (8 \times 5) + (9 \times 3) + (10 \times 2)}{16} = 7.5$	B1	
6(b)	No, there is an extreme value where a student scored 0 marks, hence causing the mean to be much smaller.	B1	
7(a)	$\sqrt{55^2 - 30^2}$ $= 46.0977$ $\approx 46.1\text{m}$	M1 A1	

7(b)	$\sin x = \frac{30}{55}$ $x = 33.0557$ $= 33.1^\circ$	M1 A1	
8(a)	$AC^2 = AB^2 + BC^2$ $= 10^2 = 6^2 + 8^2$ $= 100 = 100$ <p>Since <math>AC^2 = AB^2 + BC^2</math>, by converse of Pythagoras Theorem, <math>\triangle ABC</math> is a right-angled triangle.</p>	B1	
8(b)	$\frac{8}{6} = \frac{4}{3}$	B1	
8(c)	$XB = \frac{7}{4} \times 3$ $= 5.25 \text{ cm}$ $XC = 8 - 5.25$ $= 2.75 \text{ cm}$ <p>Students may also use this method:</p> $\angle XYB = \sin^{-1}\left(\frac{3}{4}\right)$ $= 48.5903^\circ$ $\sin 48.5903 = \frac{XB}{7}$ $XB = 5.2499$ $XC = 8 - 5.2499$ $= 2.7501$ $\approx 2.75 \text{ cm}$	M1 A1  M1 A1	
9			

	$y = 20 - 7$ $y = 13 \text{ cm}$ $x^2 + 13^2 = 20^2$ $x^2 = 231$ $\therefore \text{area of the surface of water} = \pi r^2$ $= \pi(231)$ $= 726 \text{ cm}^2$	M1 M1  A1	
<b>10(a)(i)</b>	$37 - 2x \text{ cm}$	B1	
<b>10(a)(ii)</b>	$26 - 2x \text{ cm}$	B1	
<b>10(b)</b>	$(37 - 2x)(26 - 2x) = 726$ $962 - 74x - 52x + 4x^2 = 726$ $4x^2 - 126x + 236 = 0$ $2x^2 - 63x + 118 = 0 \text{ (shown)}$	M1  A1	
<b>10(c)</b>	$(2x - 59)(x - 2) = 0$ $x = 29.5 \text{ (reject) or } x = 2$	M1 A1	No marks awarded if students do not reject 29.5
<b>11(a)</b>	4	B1	
<b>11(b)</b>	$\frac{12}{20} = \frac{3}{5}$	B1	
<b>11(c)</b>	No, as the data will be too large. No, as the process will be too tedious. No, as it would be difficult to read and obtain data.	B1	Any reasonable answers can be accepted.
<b>11(d)</b>	$\frac{60}{100} \times 20 = 12$ $\therefore \text{least score} = 66 \text{ marks}$ OR $\frac{40}{100} \times 20 = 8 \text{ students not qualified}$ $\therefore \text{least score} = 66 \text{ marks}$	M1  A1  M1  A1	
<b>11(e)</b>	Yes, as more students passed the test. Yes, as there are only 4 failures.	B1	Any reasonable answers can be accepted.
<b>12(a)</b>	$h^2 = 15^2 - 9^2$ $h = 12 \text{ cm (shown)}$	B1	

<b>12(b)</b>	Volume of cone = $\frac{1}{3} \times \pi \times 9^2 \times 12$ $= 1017.876 \text{ cm}^3$ Volume of hemisphere = $\frac{1}{2} \times \frac{4}{3} \times \pi \times 9^3$ $= 1526.814 \text{ cm}^3$ Total volume = $1017.876 + 1526.814$ $= 2544.69$ $\approx 2540 \text{ cm}^3$	M1  M1  A1	
<b>12(c)</b>	$(\pi \times 9 \times 15) + \left(\frac{1}{2} \times 4 \times \pi \times 9^2\right)$ $= 933.053$ $\approx 933 \text{ cm}^2$	M1  A1	
<b>13(a)</b>	-3, 6	B1	
<b>13(b)</b>		G1 – correct plotting G1 – smooth curve	
<b>13(c)(i)</b>	1.27 or 4.73 ( $\pm 0.1$ )	B1, B1	
<b>13(c)(ii)</b>	$x = 3$	B1	

<b>13(c)(iii)</b>	-3	B1	
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