

NAME: SAZ 2020 ()

CLASS: _____



FAIRFIELD METHODIST SCHOOL (SECONDARY)

END-OF-YEAR EXAMINATION 2020 SECONDARY 2 EXPRESS

MATHEMATICS

Paper 2

Date: 8 October 2020

Duration: 1 hour 30 minutes

READ THESE INSTRUCTIONS FIRST

Write your name, index number and class on all the 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, highlighters, glue or correction tape/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.

You are expected to use a scientific calculator to evaluate explicit numerical expressions.

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 π , use either your calculator value or 3.142, unless the question requires the answer in terms of π .

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 60.

FOR EXAMINER'S USE	
Paper 2	60

Setter: Mdm Lim Nina / Mr Joel Li

This question paper consists of 15 printed pages including the cover page.

Name: _____ ()

Class: _____

Answer **all** the questions.

1 Simplify each of the following.

(a) $\frac{25xy^6}{3y^2} \div \frac{5x^2y}{27}$

Answer [2]

(b) $\frac{a(b-c) + d(b-c)}{a+d}$

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Answer [2]

(c) $\frac{p}{1 - \frac{1}{p}}$

Answer [3]

Name: _____ () Class: _____

- 2 (a) Given that $a + b = 3$ and $ab = 2$, evaluate $a^2 + b^2$ using algebraic identities.

Answer [2]

(b) It is given that $\sqrt{\frac{x+9}{y+3}} = \frac{1}{3}$.

- (i) Make y the subject of the formula.

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Answer [3]

- (ii) Find the value of y when $x = -8$.

Answer [1]

Name: _____ () Class: _____

3 It is given that y is directly proportional to $x^2 + 1$ and $y = 10$ when $x = 7$.

(a) Find the equation connecting x and y .

(b) Find the value of y when $x = 4$. *Answer* [2]

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(c) Find the value(s) of x when $y = \frac{1}{4}$. *Answer* [1]

Answer [2]

Name: _____ () Class: _____

- 4 In a primary school, it takes 8 teachers to grade 320 essays in 10 hours.

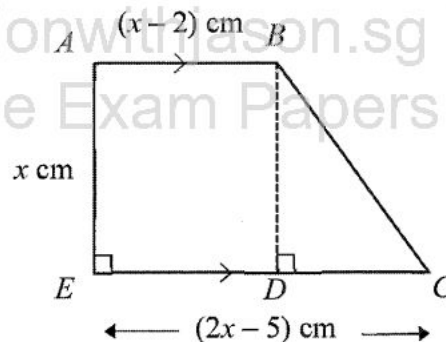
(a) How long will it take 1 teacher to grade 80 essays?

Answer hour(s) [2]

(b) State the assumption that you have made for your answer in part (a).

Answer [1]

- 5 $ABCE$ is a trapezium in which $AB \parallel EC$. $AB = (x - 2)$ cm, $EC = (2x - 5)$ cm and $AE = x$ cm.



- (a) If the area of trapezium $ABCE$ is 49 cm^2 , form an equation in x and show that it reduces to $3x^2 - 7x - 98 = 0$. [2]

Name: _____ () Class: _____

- 5 (b) Solve the equation $3x^2 - 7x - 98 = 0$.

Answer [3]

- (c) Explain why one of the values is rejected.

Answer

..... [1]

- (d) Hence, calculate the length of:

(i) *DC*

Answer cm [1]

(ii) *BC*

Answer cm [2]

Name: _____ () Class: _____

- 6 The speed, v m/s, of a sprinter t s after leaving the starting line, is given by
 $v = -0.1t^2 + 2t$.

The table below shows some corresponding values of t and v .

t	0	2	4	6	8	9	11	12	14
v	0	3.6	p	8.4	9.6	9.9	9.9	9.6	8.4

- (a) Find the value of p .

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

- (b) On the axes provided, plot the points given in the table and join them with a smooth curve. (Answer on graph paper on the next page) [3]

- (c) Using your graph in part (b), find

- (i) the maximum speed of the sprinter and the time when it occurs,

Answer The maximum speed of the sprinter is $\dots\dots\dots$ m/s and
it occurs at $\dots\dots\dots$ seconds. [2]

- (ii) the time when the sprinter's speed is 5.8 m/s.

Answer $\dots\dots\dots$ seconds [1]

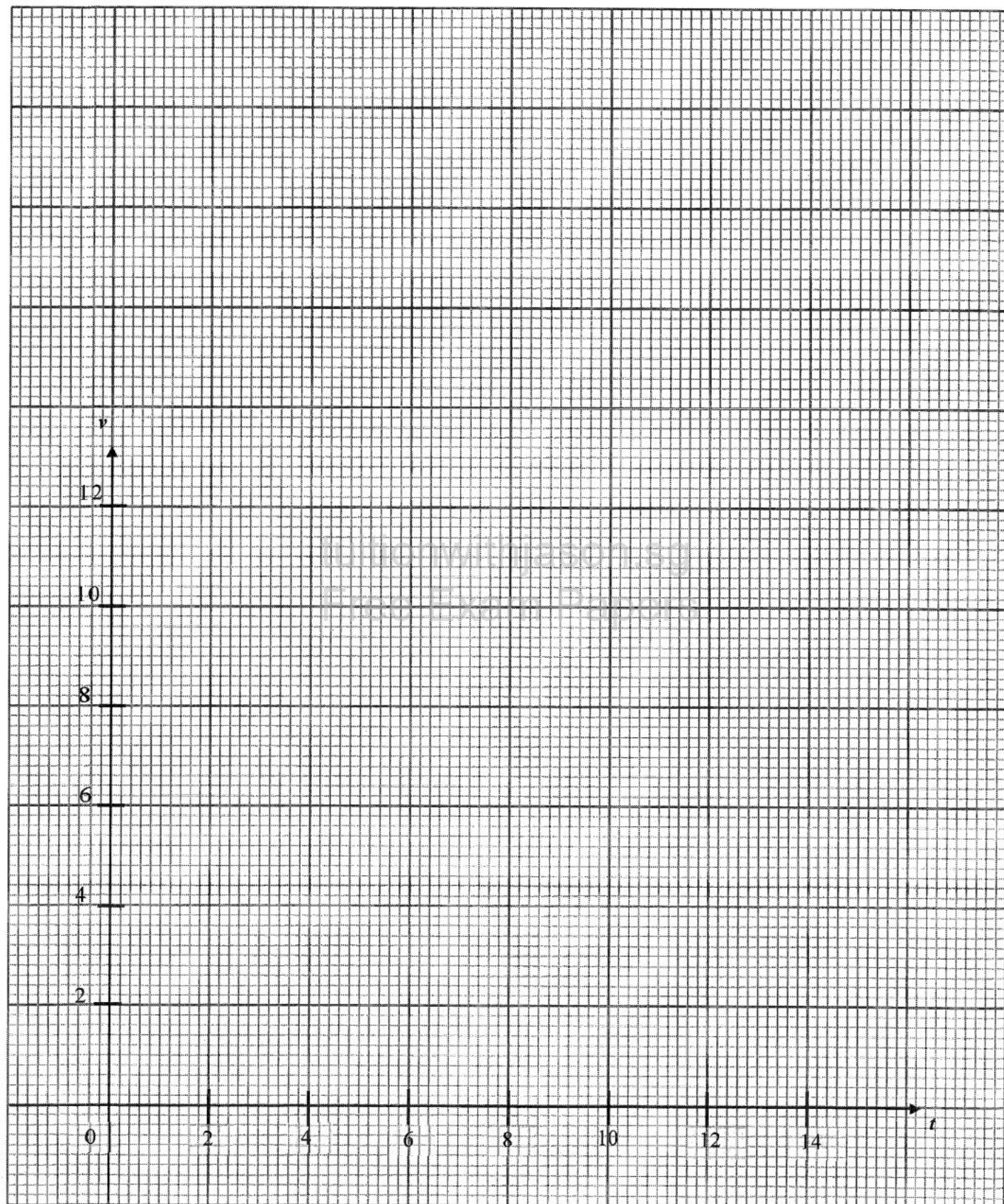
- (d) The sprinter crosses the finishing line at 12.5 seconds. Using your graph in part (b), find the speed at which the sprinter crosses the finishing line

Answer $\dots\dots\dots$ m/s [1]

Name: _____ ()

Class: _____

Answer for Question 6(b), 6(c)(i), (ii), 6(d)



- 7 A crane is a type of machine, generally equipped with wire ropes or chains that can be used both to lift and lower materials and to move them horizontally. It is mainly used for lifting heavy things and transporting them to other places. Diagram 1 shows an example of such a crane.



Diagram 1

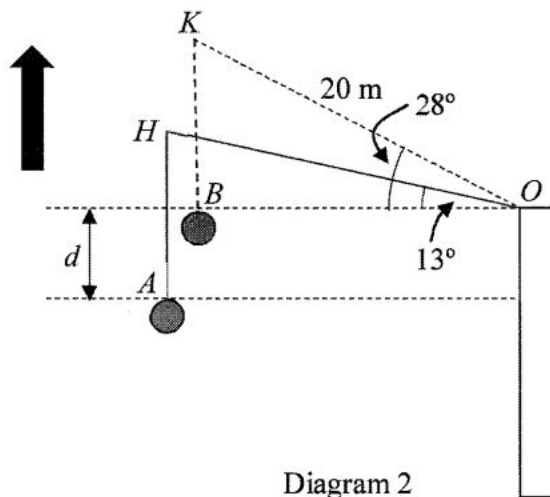


Diagram 2

In diagram 2, a crane arm 20 metres long lifts a parcel from A to B . At position A , the parcel is connected to the crane arm with a chain, HA .

When the parcel is at A , the crane arm makes an angle of 13° with the horizontal line BO .

When the parcel is at B , the crane arm makes an angle of 28° with the horizontal line BO .

Assume that the chain is always taut and vertical.

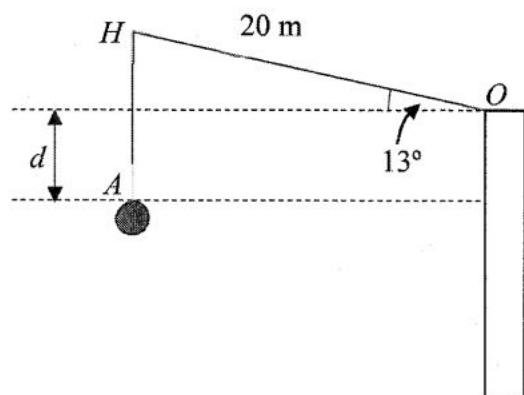
- (a) Find the length of the chain, HA .

Answer m [2]

Name: _____ ()

Class: _____

- 7 (b) Find the vertical distance, d , moved by the parcel.

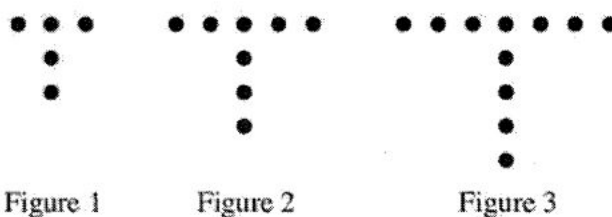


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Answer m [2]

Name: _____ () Class: _____

- 8 Alex uses coins to make a sequence of figures. The first three figures are as shown.



- (a) Draw the 4th figure. [1]

- (b) Complete the table. [1]

Figure number (n)	1	2	3	4	5
Number of coins	5	8			

- (c) Write down an expression, in terms of n , for the number of coins needed to form Figure n .

Answer [1]

- (d) Hence, find the Figure number which is made up of 470 coins.

Answer [1]

- (e) Is it possible for a figure in the sequence to be made up of 594 coins?

Explain your answer.

Answer

 [1]

Name: _____ () Class: _____

- 9 A group of athletes took part in a selection race to represent Singapore for the ASEAN Junior Track & Field 100-metre race. The stem-and-leaf diagram shows the time, in seconds, taken by the group of athletes to complete the race.

11		3 4
11		5 6 6 8 8 9
12		0 0 1 1 3 3 4
12		5 8
13		0 1
13		7

Key: 11|4 means 11.4 seconds

- (a) Find the number of athletes who took part in the selection race.

Answer athletes [1]

- (b) Find the time taken by the fastest athlete.

Answer seconds [1]

- (c) The top 15% of the group of athletes were selected to represent Singapore. What is the timing of the last athlete in this group who is able to represent Singapore for the 100-metre race.

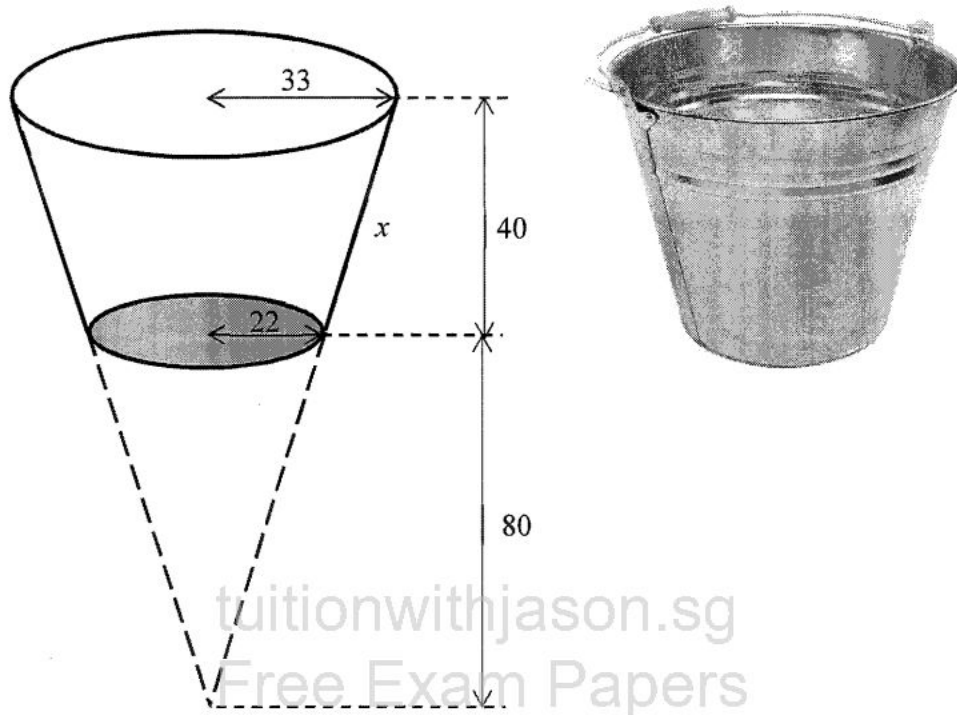
Answer seconds [1]

- (d) An athlete is selected at random from this group. Find the probability that the athlete completed the race in less than 12 seconds. Leave your answer in its simplest form.

Answer [1]

Name: _____ () Class: _____

- 10 The diagram shows a bucket which is part of a right circular cone of height 120 cm. The open end of the bucket is a circle of radius 33 cm. The base of the bucket is a circle of radius 22 cm. The height of the bucket is 40 cm. The slant height of the bucket is x cm. [You may ignore the thickness of the material of the bucket.]



- (a) Show that $x = 41.5$, correct to 3 significant figures.

[2]

Name: _____ () Class: _____

10 (b) Calculate the external surface area of the bucket (inclusive of the base).

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Answer cm^2 [3]

Name: _____ () Class: _____

- 10 (c) The total external surface area of the bucket (inclusive of the base) is to be painted.

Two layers of paints are needed – a foundation layer and the actual layer.

Mr Tan has to decide which one of the following brands to choose to paint twenty such buckets.

Brand	Delux	Nupont
Cost per can	\$24.60 for a 500-ml can	\$37.50 for a 1-litre can
Paint coverage per litre	80 000 cm ²	70 000 cm ²

Determine the number of cans of paint Mr Tan would require for each brand and hence the brand he would choose to save costs.

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Answer Mr Tan would choose the brand because

.....

.....[4]

- End of Paper 2 -

NAME: _____ ()

CLASS: _____



FAIRFIELD METHODIST SCHOOL (SECONDARY)

END-OF-YEAR EXAMINATION 2020 SECONDARY 2 EXPRESS

MATHEMATICS

Paper 1

Date: 7 October 2020

Duration: 1 hour 30 minutes

Candidates answer on the Question Paper.

READ THESE INSTRUCTIONS FIRST

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

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

The total number of marks for this paper is 60.

For Examiner's Use	
Paper 1	/ 60
Paper 2	/ 60
	%

Setter: Mdm Lee SP

This question paper consists of **16** printed pages including the cover page.

Name: _____ ()

Class: _____

- 1 Find the sum of all the prime numbers between 45 and 60.

Answer [1]

-
- 2 On a certain day in the year 2020, Singapore reported 500 new Covid-19 cases, corrected to the nearest hundred. Write down the minimum number of new Covid-19 cases on that day.

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Answer [1]

-
- 3 Petrol costs x cents per litre.
Find an expression for the number of litres of petrol that can be bought for y dollars.

Answer litres [2]

Name: _____ () Class: _____

- 4 Sam bought a digital camera at a discount of 15% and paid \$1250.35 for it.
Calculate the marked price of the digital camera.

Answer \$ [2]

-
- 5 A bag contains 8 red marbles, 7 blue marbles and 5 yellow marbles.
A marble is chosen at random.

(a) Find the probability of getting a blue or yellow marble.

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Answer [1]

- (b) How many more red marbles must be placed in the bag so that the probability of
choosing a red marble would be $\frac{2}{3}$?

Answer [1]

Name: _____ ()

Class: _____

6 Solve $4x^2 - 4x = 3$.

Answer [2]

7 The number 972 written as a product of its prime factors is $2^2 \times 3^5$.

(a) Express 504 as a product of prime factors, leaving your answer in index notation.

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Answer 504 = [1]

(b) Using the result of part (a), find the smallest integer value of n such that $504n$ is a multiple of 972.

Answer n = [1]

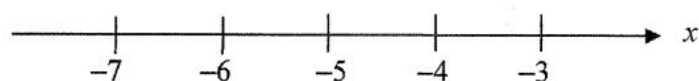
Name: _____ ()

Class: _____

- 8 (a) Solve the inequality $-3x \leq 17$.

Answer [1]

- (b) Illustrate the solution for part (a) on the number line.



[1]

- (c) State the smallest rational value of x that satisfies the inequality $-3x \leq 17$.

Answer [1]

Name: _____ ()

Class: _____

9 Expand and simplify the following.

(a) $(7p - 8)^2$

Answer [2]

(b) $(a - c)(a^2 + ac + c^2)$

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Answer [2]

10 Factorise the following expressions completely.

(a) $6p^2 - 3pq - 10ap + 5aq$

Answer [2]

Name: _____ ()

Class: _____

10 (b) $49(x-1)^2 - 25y^2$

Answer [2]

11 Express $\frac{1}{x^2 - 3x - 4} - \frac{1}{x - 4}$ as a single fraction in its simplest form.

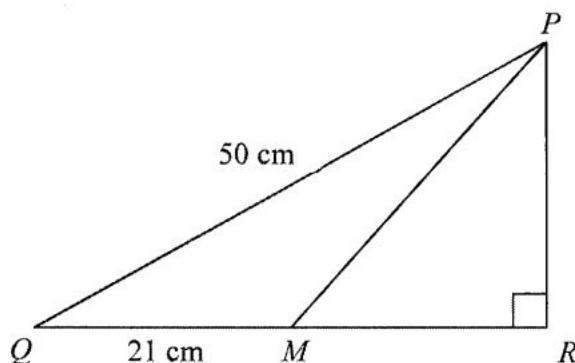
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Answer [3]

Name: _____ ()

Class: _____

- 12 In triangle PQR , angle $PRQ = 90^\circ$, $PQ = 50$ cm and $QM = 21$ cm.
 M is the midpoint of QR where $QM = MR$.



- (a) Find the length of PR .

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Answer $PR = \dots\dots\dots$ cm [2]

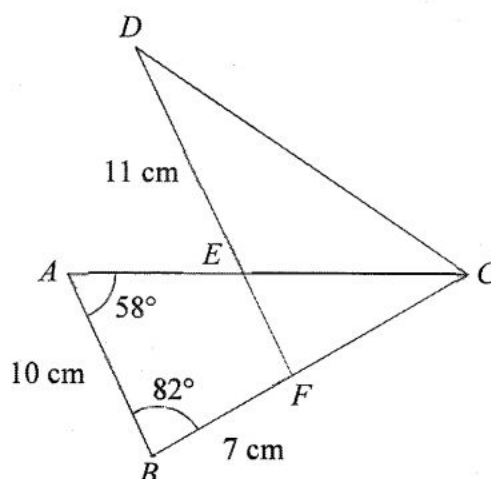
- (b) Find angle QMP .

Answer Angle $QMP = \dots\dots\dots^\circ$ [2]

Name: _____ ()

Class: _____

- 13 In the figure (not drawn to scale), $\triangle ABC \cong \triangle CFD$. DEF , AEC and BFC are straight lines.
 $DE = 11$ cm, $AB = 10$ cm, $BF = 7$ cm, angle $BAC = 58^\circ$ and angle $ABC = 82^\circ$.



- (a) Find the length of EF .

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Answer $EF =$ cm [1]

- (b) Find $\angle DCE$.

Answer $\angle DCE =$ $^\circ$ [2]

- (c) What can you conclude about the lines AB and DF ? Give a reason.

Answer

..... [1]

Name: _____ () Class: _____

14 It is given that 4 cm on a map represents 5 km on the ground.

- (a) Express the scale of the map in the form $\frac{1}{n}$, where n is an integer.

Answer [1]

- (b) On the map, a lake has an area of 7.2 cm². Calculate in km², the actual area of the lake.

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Answer km² [2]

- (c) A second map has a scale of 1 : 50 000. Find the area of the lake on this second map.

Answer cm² [2]

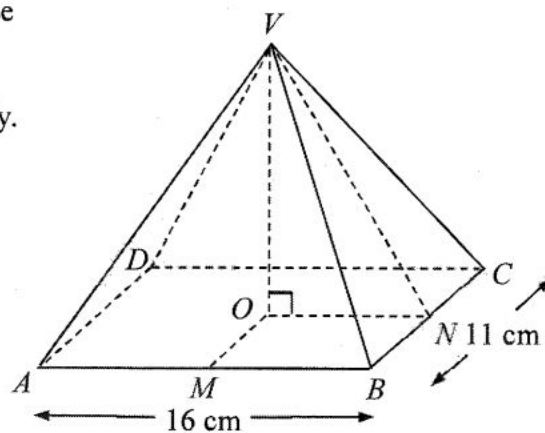
Name: _____ ()

Class: _____

- 15 $VABCD$ is a solid pyramid with a rectangular base of sides 16 cm by 11 cm.

M and N are midpoints of AB and BC respectively.

The volume of the pyramid is 880 cm^3 .



- (a) Find VO , the height of the pyramid.

Answer cm [1]

- (b) Find the total surface area of the pyramid.

Answer cm^2 [3]

Name: _____ () Class: _____

- 15 (c) The solid pyramid, $VABCD$ is melted to form 20 identical solid spheres.
Find the curved surface area of each sphere.

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Answer cm^2 [3]

Name: _____ () Class: _____

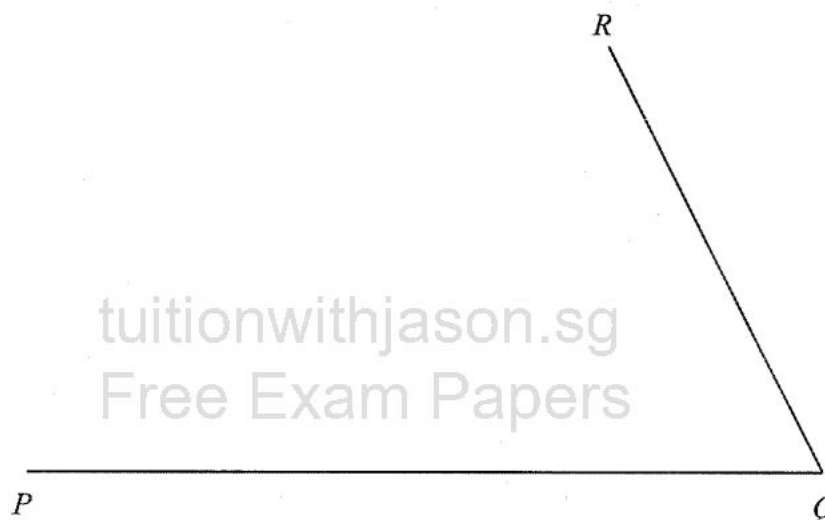
- 16 A plot of land $PQRS$ is to be used for a park.

Part of a scale drawing of the land is shown below.

On the scale drawing, 1 centimetre represents 15 metres.

All construction arcs must be shown clearly for marks to be awarded.

Answers for (a), (b), (c), (d)

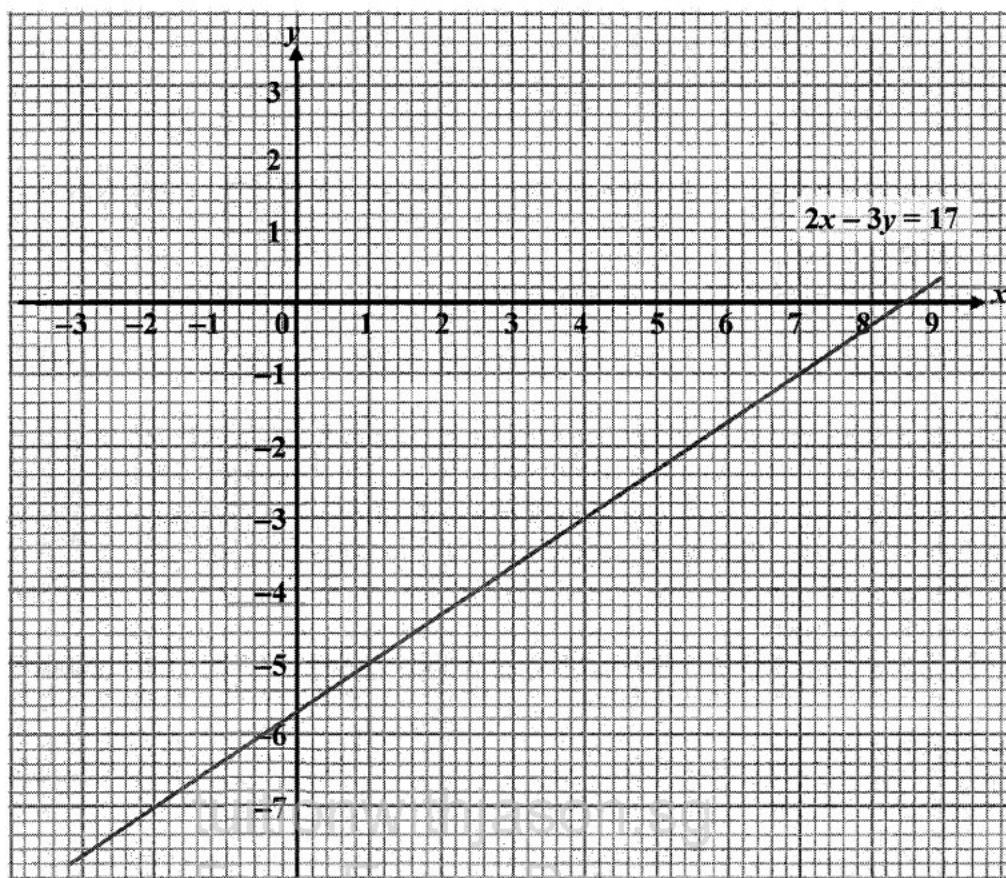


- (a) On the land, $RS = PS = 105$ m. On the scale drawing, construct the lines RS and PS .
Label point S . [2]
- (b) Construct the perpendicular bisector of RQ . [1]
- (c) Construct the bisector of angle PQR . [1]
- (d) A water fountain is to be built on this plot of land, nearer to Q than R , and nearer to QP than QR . Shade the region where the water fountain is to be built. [1]

Name: _____ ()

Class: _____

- 17 (a) The diagram shows the graph of $2x - 3y = 17$.



- (i) The variables x and y are connected by another equation $3x + 2y = 6$.

x	0	2	6
y	3	0	p

Calculate the value of p .

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

- (ii) On the same diagram, plot the draw the graph of $3x + 2y = 6$. [2]

Name: _____ ()

Class: _____

- 17 (a) (iii) Hence, solve the pair of simultaneous equations.

$$2x - 3y = 17$$

$$3x + 2y = 6$$

Answer $x = \dots\dots\dots$, $y = \dots\dots\dots$ [1]

- (b) For another pair of simultaneous equations, where c is a real number, there is an infinite number of solutions.

$$3x + 2y = 11$$

$$15x + 10y = c$$

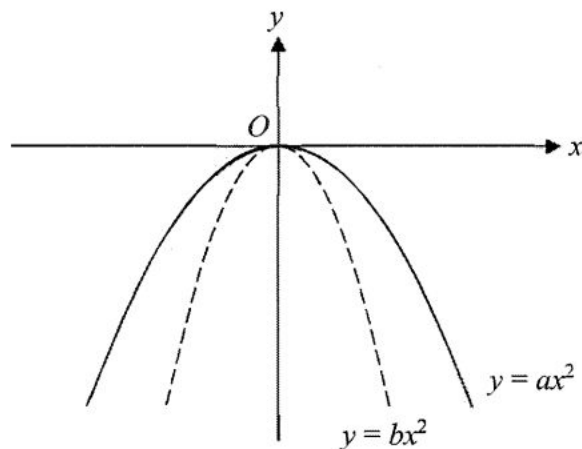
State a possible value of c .

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

Name: _____ () Class: _____

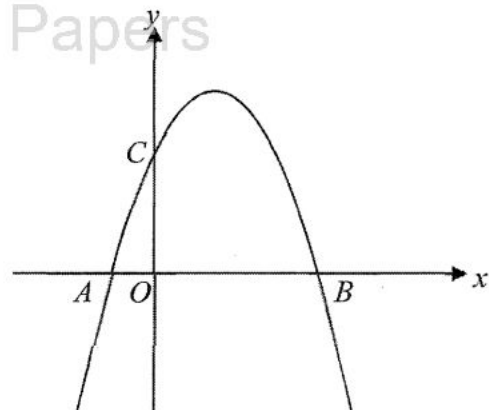
- 18 (a) The figure below shows the graphs of $y = ax^2$ and $y = bx^2$, where a and b are real numbers.



Fill in the boxes with the inequality signs ' $>$ ' or ' $<$ ' to make the mathematical statement true.

Mathematical statement: a 0 , b 0 , a b . [1]

- (b) The curve $y = 3 + 2x - x^2$ cuts the x -axis at two points A and B , and the y -axis at C .



Find

- (i) the coordinates of A and C ,

Answer A (..... ,) [1]

C (..... ,) [1]

- (ii) the equation of the line of symmetry.

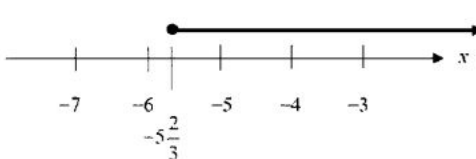
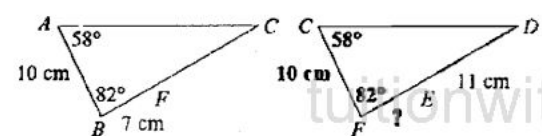
Answer [1]

End of paper

SECONDARY 2EXP MATHEMATICS
EOY PAPER 2 2020 Answer Key

Qn	Answer	Qn	Answer
1a	$\frac{45y^3}{x}$	8a	
1b	$b - c$	8b	11, 14, 17
1c	$\frac{p^2}{p-1}$	8c	$3n+2$ or $5+3(n-1)$
2a	5	8d	156
2bi	$y = 9x + 78$	8e	No. $(594 - 2) = 592$ cannot be divided by 3, so n will not be an integer.
2bii	6	9a	20 athletes
3a	$y = \frac{1}{5}(x^2 + 1)$	9b	11.3 seconds
3b	3.4 or $3\frac{2}{5}$	9c	11.5 seconds
3c	$x = \pm \frac{1}{2}$	9d	$\frac{2}{5}$
4a	20 hours	10a	$x^2 = 11^2 + 40^2$ (Pythagoras Thm) $x = 41.484$ (5s.f) $x = 41.5$ (3s.f)
4b	Each teacher grade the essays at the same pace/rate/speed.	10b	8690 cm ² (3s.f)
5a	$\frac{1}{2}(x)(x-2+2x-5) = 49$ $(x)(3x-7) = 98$ $3x^2 - 7x - 98 = 0$ (shown)	10c	Total external surface area of 20 buckets $= 8692.36 \times 20$ $= 173847.2$ cm ² (7sf) Amount of paint coverage required for 20 buckets (because of double layer of paint) $= 173847.2 \times 2$ $= 347694.4$ cm ² (7sf) Number of litres required for Delux paint $= 347694.4 \div 80\,000$ $= 4.3462$ litres (5sf) Number of cans needed for Delux = $\frac{4.3462}{0.5}$ ≈ 9 cans Cost of using Delux = 9×24.60 $= \$221.40$ Number of litres required for Nupoint paint $= 347694.4 \div 70\,000$ $= 4.9671$ litres (5sf) Number of cans needed for Nupoint $= 4.9671 \div 1$ ≈ 5 cans Cost of using Nupoint = $5 \times \$37.50$ $= \$187.50$ Therefore, Mr Tan should choose Nupoint as it is the cheaper option.
5b	$x = 7$ or $x = -4\frac{2}{3}$		
5c	$x = 4\frac{2}{3}$ is rejected because x represents length and length cannot be negative in value.		
5di	$DC = 4$ cm		
5dii	$BC = 8.06$ cm (to 3s.f)		
6a	$p = 6.4$		
6ci	Acceptable values: 10 or 10.1 or 10.2 m/s, 10 s		
6cii	Acceptable values: 3.3 or 3.4 or 3.5 or 3.6		
6d	Acceptable values: 9.3 or 9.4 or 9.5		
7a	$HA = KB = 9.39$ m		
7b	4.89m		

FMSS EOY 2020 Secondary Two Express
Mathematics Paper 1 Answer Key

1) $47 + 53 + 59 = 159$	2) 450 cases	3) $\frac{100y}{x}$ litres	4) \$1471
5a) $\frac{3}{5}$	5b) 16	6) $x = \frac{3}{2}$ or $x = -\frac{1}{2}$	7a) $504 = 2^3 \times 3^2 \times 7$
8a) $x \geq -5\frac{2}{3}$	8c) $-5\frac{2}{3}$	8b)	
			
9a) $49p^2 - 112p + 64$	10a) $(2p - q)(3p - 5a)$	9b) $a^3 - c^3$	10b) $(7x - 7 + 5y)(7x - 7 - 5y)$
11) $\frac{-x}{(x+1)(x-4)}$	12a) 27.1 cm (3sf)	12b) 127.7° (1dp)	
13) Redrawing the triangles in the same orientation:	13a) 6 cm	13b) 18°	
	13c) Since $\triangle ABC \cong \triangle CFE$, $\angle CFD = \angle ABC = 82^\circ$. Thus, AB is <u>parallel</u> to DF (by <u>converse of corresponding angles</u>). or Since $\triangle ABC \cong \triangle CFE$, $\angle CFE = \angle ABC = 82^\circ$. They <u>form a pair of corresponding angles</u> and therefore AB is parallel to DF .		
14a) $\frac{1}{125000}$	14b) 11.25 km^2	14c) 45 cm^2	15a) 15 cm 15b) 619 cm^2 (3sf) [a rectangular base means there are 2 different sets of triangles] 15c) 60.3 cm^2 (3sf)
17ai) $p = -6$	17aiii) $x = 4, y = -3$	18a) $a < 0; b < 0; a > b$	
17b) Since there is an infinite number of solutions, the two lines coincide. That is, it is the same line. $c = 11 \times 5 = 55$.	18bi) $A(-1, 0); C(0, 3)$	18bii) $x = 1$	

16)

