BEDOK SOUTH SECONDARY SCARCE	BED END	OK SOUTH SECONDARY SCHOOL -OF-YEAR EXAMINATION 2023	2EXP
CANDIDATE NAME			
CLASS		INDEX NUMBER	

### MATHEMATICS

PAPER 1

4052/01

1 hour

9 October 2023

Candidates answer on the Question Booklet.

#### READ THESE INSTRUCTIONS FIRST

Write your class, index number and name on all the work you hand in. Write in dark blue or black ink on both sides of the paper. Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer all questions.

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

If working is needed for any question it must be shown in the space below the question. Omission of essential working will result in loss of marks. The total of the marks for this paper is **40**.

The use of an approved scientific calculator is NOT ALLOWED.

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	Examine	r's Use	20
Penalty	Question No.		
Units			Mark
Presentation			-1 / -2
Sub-Total		Total	40

#### Answer all the questions.

1 Expand and simplify (3x+4)(2-x)-3(x-1).

2 Factorise completely  $x^2 + 7x - 7xy - 49y$ .

3 Factorise completely  $(p+3)^2 - (2q-1)^2$  using special products of algebraic expressions.

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4 Express as a single fraction in its simplest form  $\frac{2p-1}{2} \div \frac{4p^2-4p+1}{2p-4}$ .

3

5 Express as a single fraction in its simplest form  $\frac{2}{a+1} - \frac{5}{4a+3}$ .

D

9

С

6 The diagram shows two right angled triangles, *ABD* and *BCD*. AB = 17 cm, AD = 8 cm, BC = 12 cm, BD = 15 cm and CD = 9 cm.A studykak

17

15

12

Find, in fractions in its simplest form, the values of (a)  $\sin \angle BDC$ ,

B

(b)  $\tan \angle ABD$ .

The following table shows some values of a and b.

a	6	4	3
b	3	8	15

Determine whether a is inversely proportional to the square root of b + 1.

Answer

7

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8 p is directly proportional to the square of q. The sum of the values of p when q = 2 and q = 3 is 26. Find p when q = 4.

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#### 9 The test marks of a group of students are shown in the stem-and-leaf diagram.

0	5	7	9		
1	1	X	4	5	8
2	3				
3	8				

Key: 1 | 5 means 15

(a) Find the value of x if the median score is 12.5.

Stanswer [1]

(b)

 $\frac{2}{5}$  of the students scored more than y. Find the value of y.

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(c) Explain why the mean may not be an appropriate average to use to summarise the scores of the students.

Answer

.....[1]

- 10 Wendy bought 20 boxes of strawberries at \$6 each. She later threw away x boxes which were spoilt and sold the remaining boxes at \$8 each.
  - (a) Write down an expression in terms of x to represent the amount Wendy received from selling the strawberries and show that it simplifies to 160-8x.

Answer

(b) By forming and solving an inequality, find the maximum number of spoilt boxes if Wendy did not make a loss.

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11 In the diagram, triangle ABC is congruent to triangle EFD.  $\angle BAC = 89^{\circ}$ ,  $\angle DFE = 61^{\circ}$ , BC = 8 cm, CD = 4 cm, DE = 7 cm and EF = 4 cm.









12 The shorter side of a rectangle is x cm.



(a) Write down an expression in terms of x to represent the length of the longer side of the rectangle, given that the area of the rectangle is  $35 \text{ cm}^2$ .

(b) Write down an expression in terms of x to represent the length of the longer side of the rectangle, given that the perimeter of the rectangle is 24 cm. Show that it simplifies to (12-x) cm.

Answer

[1]

[1]

- (c) Equate the two expressions of the
  - Equate the two expressions of the length of the longer side of the rectangle from parts (a) and (b) and show that it simplifies to

$$x^2 - 12x + 35 = 0$$

Answer

(d) Solve the equation  $x^2 - 12x + 35 = 0$ . Find the lengths of the shorter and longer sides of the rectangle.

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Answer: Length of shorter side = .....

Length of longer side =  $\dots$  [3]

- 13 Let x be the tens digit and y be the ones digit of a two-digit number, represented as 10x + y.
  - (a) The number is equal to 4 times the sum of its digits. Write down an equation in x and y to represent this information and show that it simplifies to 2x - y = 0.

Answer

[1]

[1]

(b) The number formed by reversing its digits, represented as 10y + x, is 9 more than the original number.

Write down an equation in x and y to represent this information and show that it simplifies to x - y = -1.

Answer

#### (c) Solve these two equations to find the two-digit number.

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**End of Paper** 



Candidates answer on the Question Booklet.

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Answer all questions.

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

If working is needed for any question it must be shown in the space below the question. Omission of essential working will result in loss of marks. The total of the marks for this paper is **60**.

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 your calculator value or 3.142.

	Examine	r's Use	11 S. S.
Penalty	Ques	stion No.	
Units			
Accuracy			Mark 1 /2
Presentation			
Sub-Total		Total	60

2 October 2023

1 hour 30 minutes

#### Answer all the questions.

1 It is given that 
$$p = \frac{q-1}{q-r}$$
.  
(a) Find p when  $q = 7$  and  $r = 4$ 

(b) Express q in terms of p and r.



#### 

2 Solve the following pair of simultaneous equations.

3x - 2y = 56x + 9y = -16

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- Mass (kg)
   Frequency

    $2.0 \le m < 2.5$  4

    $2.5 \le m < 3.0$  x

    $3.0 \le m < 3.5$  19

    $3.5 \le m < 4.0$  12

    $4.0 \le m < 4.5$  4
- 3 The masses of some newborn babies born in a hospital are shown in the grouped frequency table.

(a) Find the largest possible value of x if

(i) the modal class interval is  $3.0 \le m < 3.5$ .

(ii) the median lies in the class interval  $3.0 \le m < 3.5$ , Studykaki.com

(b) Calculate an estimate of the mean mass of the babies if x is 11.

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 (c) It was discovered that all the data collected had an error. The correct masses were all 0.5 kg less than those collected. Explain how the estimate of the mean mass will change after the error is corrected.

Answer

......[1]

The first five terms in a sequence of numbers are given below.

 $T_1 = 1^2 + 1 = 2$   $T_2 = 2^2 + 2 = 6$   $T_3 = 3^2 + 3 = 12$   $T_4 = 4^2 + 4 = 20$  $T_5 = 5^2 + 5 = 30$ 

4

(a) Find an expression, in terms of n, for the *n*th term,  $T_n$ , of this sequence.

(b) One term in the sequence is 72. Hence, find the value of *n* for this term.

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(c)	Explain why	the value of $T_{\rm m}$	must be even	for all	values of <i>n</i> .
-----	-------------	--------------------------	--------------	---------	----------------------

	Answer
	[1]
(d)	The first 5 terms of another sequence are 1, 5, 11, 19, 29. By comparing this sequence with the sequence above, write down the <i>n</i> th term of the new sequence.

5 In the diagram, triangle *ABF* is an enlargement of triangle *DBC* and a reduction of triangle *ADE*.

 $\angle AFB = 63^{\circ}$ ,  $\angle BDC = 75^{\circ}$ , AF = 9 cm, BF = 13 cm and DE = 19.5 cm.



#### Calculate

(a) the ratio AF : AE,



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**(b)** *EF*,

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(c)  $\angle DBF$ .

The diagram shows a smaller cone removed from a larger cone of the same height of 12 cm.



The smaller cone has a radius of 5 cm and slant height of 13 cm. The larger cone has a radius of 9 cm and slant height of 15 cm.

Find an expression, in terms of  $\pi$ , for the volume of the remaining solid, (a)

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6

(b) the total surface area of the remaining solid.

The diagram shows a tent in the shape of a right rectangular pyramid ABCDX.



The tent has base lengths AB = 210 cm and BC = 150 cm and slant heights MX = 125 cm and NX = 145 cm.

Calculate

7

(a) the vertical height, OX, of the tent,

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(b) the volume of the tent,

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(c) the total surface area of the tent, including the base.

8 The diagram shows two triangles ADE and CDE. AE = 60 cm, CD = 28 cm, CE = 96 cm and DE = 100 cm.



(a) Show that triangle *CDE* is a right-angled triangle.

Answer



(b) Find the shortest distance from C to DE.

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(c) Calculate  $\angle AED$ .

(d) Calculate  $\angle AEC$ .

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(e) Calculate AB.

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A pebble is thrown from a cliff into the sea. 9 The height, h metres, of the pebble above sea level at time, t seconds, is given by the equation  $h = -5t^2 + 8t + 16.8$ .

Some corresponding values of t and h are given in the table below.

t/s	0.0	0.4	0.8	1.2	1.6	2.0	2.4	2.8
<i>h /</i> m	16.8	19.2	20.0	19.2	16.8	12.8	р	0.0

Find the value of *p*. (a)

On the grid on the next page, using a scale of 1 cm to represent 0.2 s, draw a (b) horizontal *t*-axis for  $0.0 \le t \le 2.8$ . On the same grid, using a scale of 1 cm to represent 1 m, draw a vertical h-axis for  $0.0 \le h \le 20.0$ . On your axes, plot the points given in the table and join them with a smooth curve.

[3]

Use your graph to find (c) the coordinates of the turning point of the curve, (i)

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the equation of the line of symmetry, **(ii)** 

the times when the pebble is 18 m above sea level. (iii)



10 The diagram shows the floor plan of a 3-room flat owned by Mr Tan.



(a) Bedroom 2 is 3 m by 4 m.By making measurements of the floor plan, write the scale of the floor plan in the form 1 : n.

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- (b) The cost, \$ c, of a 6 mm thick square ceramic tile is directly proportional to the square of its width, w cm.
  - A tile with a width of 60 cm cost \$14.40.
  - (i) Find an equation for c in terms of w.

kaki.com Find the cost of a tile with a width of 90 cm. (ii)

Mr Tan needs to work out how much money he will need to cover the floor renovation. He finds the information below to help him work out the costs. He realises that the cost to cover floor renovation comprises costs for material and labour.

Average	costs for different types of floori	ng options	
Flooring material	Material cost per m <sup>2</sup>	Labour cost per m <sup>2</sup>	
Cement screed	\$250 inclu	ding labour	
Ceramic tiles	\$40	\$70	
Laminate	\$80 includ	ding labour	
Marble	\$600	\$120	
Parquet	\$500 inclu	ding labour	
Vinyl	\$60 including labour		

#### 1100 • . .

(c) (i) The area of kitchen on the floor plan is 14.6 cm<sup>2</sup>.
 Calculate the costs of using laminate for Mr Tan's kitchen floor.

(ii) Mr Tan would like to use cement screed for his living room, vinyl for both bedrooms and ceramic tiles for both bathrooms.
 Suggest a suitable amount of money Mr Tan should set aside for his floor renovation, including kitchen.
 Justify the decision you make and show your calculations clearly.

Answer

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......[4]

#### **End of Paper**

Qn	Solutions	Marks	Remarks
1	<b>Expansion and Factorisation of Algebraic Expressions</b>	2	
	(3x+4)(2-x)-3(x-1)		Award M1 if correctly expand
	$= 6x - 3x^2 + 8 - 4x - 3x + 3$	M1	(3x+4)(2-x)
	$=-3x^2-x+11$	AI	
2	Expansion and Factorisation of Algebraic Expressions	2	
	$x^2 + 7x - 7xy - 49y$	MI	
	= x(x+7) - 7y(x+7)		Award M1 if correctly factorise $(x + 7)$ or $(x - 7y)$
	=(x+7)(x-7y)		(x+7) of $(x-7y)$
3	Expansion and Factorisation of Algebraic Expressions	2	
	$(p+3)^2 - (2q-1)^2$	MI	
	= [(p+3) + (2q-1)][(p+3) - (2q-1)]	IVII	Do not award if did not make
	= (p+3+2q-1)(p+3-2q+1)		use of special product
	= (p+2q+2)(p-2q+4)	A1	
4	Algebraic Fractions and Formulae	2	
	$2p-1$ , $4p^2-4p+1$		
	$\frac{1}{2}$ $\frac{1}{2p-4}$		
	2p-1, $2(p-2)$	MI	Award M1 if correctly factorice
	$= \frac{1}{2} \times \frac{(2p-1)^2}{(2p-1)^2}$	IVII	A ward With Confectly factorise $4n^2 - 4n + 1$ to $(2n - 1)^2$
	p-2		-pp + 1 to $(2p - 1)$
	$=\frac{1}{2p-1}$	A1	
5	Algebraic Fractions and Formulae	2	
	2 5		
	a+1 $4a+3$		
	$=$ $\frac{2(4a+3)}{5(a+1)}$	MI	Award M1 if compathy make
	(a+1)(4a+3) $(a+1)(4a+3)$	IVII	common denominator
	$=\frac{2(4a+3)-5(a+1)}{2}$		
	(a+1)(4a+3)		
	$\underline{8a+6-5a-5}$		
	(a+1)(4a+3)		Penalise presentation if further
	-3a+1	A1	Do not award if expand
	$-\frac{1}{(a+1)(4a+3)}$		denominator wrongly
6	Trigonometric Ratios of Acute Angles	2	
(a)	$\sin \langle BDC - \frac{BC}{12} - 4$	<b>B</b> 1	Do not award if fraction not
	$\sin 2BDC = \frac{BD}{BD} = \frac{15}{15} = \frac{15}{5}$		simplified
(b)	$\tan \langle ABD = \frac{AD}{a} = \frac{8}{a}$	B1	
	BD = 15		
7	Proportion	2	
	If a is inversely proportional to $\sqrt{b+1}$ , then $a\sqrt{b+1}$ is a		
	constant.		
	$6\sqrt{3} + 1 = 6\sqrt{4} = 6(2) = 12$		
	$4\sqrt{8+1} = 4\sqrt{9} = 4(3) = 12$		Accept if use $k$ to find other
	$3\sqrt{15+1} = 3\sqrt{16} = 3(4) = 12$	M1	values of a

### EM2 EOY 2023 PAPER 1 MARKING SCHEME

	Since $a\sqrt{b+1} = 12$ for the values given in table, <i>a</i> is		Do not accept if only check 2
	inversely proportional to $\sqrt{b+1}$ .	Al	pairs of values
8	Proportion	3	
	$p \propto q^2$		
	Let $p = kq^2$ , where k is a constant,		
	When $q = 2$		
	$n = k 2^2$		
	p = 4k		
	When $q = 3$ .		
	$p = k3^2$		
	p = 9k		
	4k + 9k = 26	M1	Award M1 if correctly form
	13k = 26	2.44	equation
	<i>k</i> = 2	M1	Award M1 if correctly find $k$
	$\therefore p = 2q^2$		
	When $q = 4$ ,		
	$p = (2)4^2$		
	<i>p</i> = 32	A1	
9	Statistical Diagrams and Measures of Central Tendency	3	
(a)	$\frac{10+x+14}{10+x+14} = 12.5$		rlali aam
	2	uu.	YKAKI.COIII
	$x + 24 = 2 \times 12.5$		
	x = 25 - 24	B1	
(b)	2		
	Number of students scored more than $y = \frac{-5}{5} \times 10$		
	= 4 students		
	y = 14 marks	B1	
(c)	Mean can be affected by outlier/extreme values.	B1	
10	Linear Inequalities	4	
(a)	8(20-x)	D1	
	=160-8x (shown)	DI	
(D)	$100 - 8x \ge 0 \times 20$ $160 - 8x \ge 120$	IVII	Do not award M11 II > instead of
	$160 - 3x \ge 120$ $160 - 120 \ge 8x$		2
	$8x \le 40$		
	$x \leq 5$	M1	Do not award if did not form
	$\therefore$ Wendy did not make a loss if the maximum number of		and solve inequality
	strawberries boxes spoilt is 5.	A1	
11	Congruence and Similarity	5	D I
(a)	$\angle ABC = \angle EFD = 61^{\circ}$ (corr. $\angle SOI = \Delta$ ) $\angle BCD = \angle ABC + \angle BAC$ (over $\angle = \text{sum of int one}$ $\angle$ )	BI	Penalise presentation for
	$= 61^{\circ} + 89^{\circ}$		doesn't correspond correctly
	=150°	B1	Penalise units
(b)	$FD = BC = 8 \mathrm{cm} (\mathrm{corr. \ sides \ of} = \Delta)$	B1	Penalise presentation for
	FC = FD - CD		missing reasons or if points
	= 8 - 4		doesn't correspond correctly
	=4 cm	B1	
L	$AC = ED = 7 \text{ cm} (\text{corr. sides of } \equiv \Delta)$		

	AF = AC - FC		
	=7-4		
	= 3  cm	B1	Penalise units
12	Quadratic Functions, Graphs and Equations	6	
(a)	35	B1	Penalise units
	$\frac{1}{x}$ cm		
(b)	$\frac{24-2x}{2} = \frac{24}{2} - x = (12-x)$ cm (shown)	B1	
(c)	25		
	$\frac{35}{3} = 12 - x$		
	x	B1	
	$35 = 12x - x^{2}$		
	$x^2 - 12x + 35 = 0$ (shown)		
(d)	$x^2 - 12x + 35 = 0$	N/1	D
	(x-5)(x-7) = 0	IVII	Do not award if did not equate
	x - 5 = 0 or $x - 7 = 0$	M1	Penalise presentation if did not
	x = 5 or $x = 7$	IVII	write 'or'
	Shorter side = 5 cm, longer side = $12-5$ or $\frac{35}{2} = 7$ cm	A1	Penalise units
	5		
13	Linear Equations in Two Variables	5	
(a)	10x + y = 4(x + y)		
	10x + y = 4x + 4y	1	1 1 .
	6x - 3y = 0	D1	VKaki.com
	2x - y = 0 (shown)	DI	
(b)	10x + y = 10y + x - 9		
	9x - 9y = -9		
	x - y = -1 (shown)	<b>B</b> 1	
(c)	0 0 (1)		Do not award if used their own
	2x - y = 0(1)		DU HUL AWAIL II USEL HEIL OWIL
	2x - y = 0(1) x - y = -1(2)		incorrect equations instead of
	2x - y = 0 - (1) x - y = -1 - (2) (1) - (2)		incorrect equations instead of given ones
	2x - y = 0 - (1) x - y = -1 - (2) (1) - (2) (2x - y) - (x - y) = (0) - (-1)	M1	incorrect equations instead of given ones Award M1 for correct
	2x - y = 0 (1) x - y = -1 (2) (1) - (2) (2x - y) - (x - y) = (0) - (-1) 2x - y - x + y = 1	M1	incorrect equations instead of given ones Award M1 for correct elimination or substitution to
	2x - y = 0(1) x - y = -1(2) (1) - (2) (2x - y) - (x - y) = (0) - (-1) 2x - y - x + y = 1	M1	incorrect equations instead of given ones Award M1 for correct elimination or substitution to form equation with one variable
8	2x - y = 0(1) x - y = -1(2) (1) - (2) (2x - y) - (x - y) = (0) - (-1) 2x - y - x + y = 1 x = 1 Sub x = 1 into (1)	M1 B1	bo not award it used then own incorrect equations instead of given ones Award M1 for correct elimination or substitution to form equation with one variable Award B1 for either x or y
8	2x - y = 0(1) x - y = -1(2) (1) - (2) (2x - y) - (x - y) = (0) - (-1) 2x - y - x + y = 1 x = 1 Sub x = 1 into (1) 2(1) - y = 0	M1 B1	bo not award it used then own incorrect equations instead of given ones Award M1 for correct elimination or substitution to form equation with one variable Award B1 for either $x$ or $y$ found
8	2x - y = 0(1) x - y = -1(2) (1) - (2) (2x - y) - (x - y) = (0) - (-1) 2x - y - x + y = 1 x = 1 Sub x = 1 into (1) 2(1) - y = 0 y = 2	M1 B1	bo not award it used then own incorrect equations instead of given ones Award M1 for correct elimination or substitution to form equation with one variable Award B1 for either $x$ or $y$ found
8	2x - y = 0 $x - y = -1$ $(1)$ $(1) - (2)$ $(2x - y) - (x - y) = (0) - (-1)$ $2x - y - x + y = 1$ $x = 1$ Sub $x = 1$ into (1) 2(1) - y = 0 $y = 2$ The two digit number is 12	M1 B1	bo not award if used then own incorrect equations instead of given ones Award M1 for correct elimination or substitution to form equation with one variable Award B1 for either $x$ or $y$ found

Qn	Solutions	Marks	Remarks
1	Algebraic Fractions and Formulae	3	
(a)	$p = \frac{q-1}{2}$		
	$p = \frac{1}{q-r}$		
	7-1		
	$p = \frac{1}{7 - 4}$		
	6		
	$p = -\frac{1}{3}$		
	p = 2	B1	
(b)	q-1		
	$p = \frac{1}{q-r}$		
	p(q-r) = q-1		
	pq - pr = q - 1	M1	Award M1 if correctly linearise
	pq - q = pr - 1		formula
	a(n-1) = nr - 1		Do not award A1 if only write
	q(p-1) = p, $1$		$\frac{pr-1}{r}$ in answer blank without
	$q = \frac{pr-1}{1}$ or $q = \frac{1-pr}{1}$	A1	p-1
	p-1 $1-p$		<i>q</i> =
2	Linear Equations in Two Variables	3	Destauration
	3x - 2y = 5(1)	1110	Do not accept guess and check
	6x + 9y = -16(2)		
	$(1) \times 2$		
	6x - 4y = 10(3)		
	(2) - (3)		
	(6x+9y) - (6x-4y) = (-16) - (10)	M1	Award M1 for correct
	6x + 9y - 6x + 4y = -10 - 16		elimination or substitution to
	13y = -26		form equation with one variable
	y = -2	A1	
	Sub $y = -2$ into (3)		
	3x - 2(-2) = 5		
	3 <i>x</i> +4=5		
	3x = 1		
	r – <sup>1</sup>	A1	Award A1 for each correct
	$x = \frac{1}{3}$	AI	solution found
	1 = 1 $1 = 2$		Solution Toulia
	$x = \frac{1}{3}, y = -2$		
3	Measures of Central Tendency	5	
(a)	x = 18	<b>B</b> 1	
(i)			
(a)	4 + x = (19 - 1) + 12 + 4		
(11)	x = 18 + 16 - 4	<b>D</b> 1	
0.5	x = 30	DI	
(b)	Estimate of the mean $4 \times 2.25 \pm 11 \times 2.75 \pm 10 \times 2.25 \pm 12 \times 2.75 \pm 4 \times 4.25$		
	$=\frac{4 \times 2.23 + 11 \times 2.73 + 19 \times 3.23 + 12 \times 3.73 + 4 \times 4.23}{4 \times 11 \times 10^{-12}}$	M1	
	4+11+19+12+4		
		I	L

### EM2 EOY 2023 PAPER 2 MARKING SCHEME

	$=\frac{163}{1}$		
	50	. 1	Develies write
	= 3.26 kg	AI	Penalise units
(c)	The estimate of the mean mass will decrease by 0.5 kg after	BI	Do not accept if did not specify
1	Number Patterns and Quadratic Functions Granhs	5	decrease by 0.5 kg
-	and Equations	5	
(a)	$T_n = n^2 + n$	B1	Accept $T_n = n(n+1)$
(b)	$n^2 + n = 72$		e.c.f. of general term
	$n^2 + n - 72 = 0$		
	(n-8)(n+9) = 0	M1	
	n - 8 = 0 or $n + 9 = 0$	4.1	Penalise presentation if did not
	n=8 or $n=-9$ (reject)	AI	white of s
(c)	When <i>n</i> is odd, $n^2$ will also be odd and their sum will be	B1	
	even. When <i>n</i> is even, $n^2$ will also be even and their sum		
	will be even.		
	When <i>n</i> is odd, $n+1$ will be even and their product will be	B1	
	even. When <i>n</i> is even, $n+1$ will be odd and their product		
	will be even.		
(d)	$T_n = n^2 + n - 1$	B1	e.c.f. of general term of above
5	Congruence and Similarity		sequence
(a)	$\Delta F \cdot AE$	- 3	
(4)	BF: DE		
	13 : 19.5		
	2:3	<b>B1</b>	
(b)	$\triangle ABF$ is similar to $\triangle ADE$ .		
	$\frac{AF + EF}{AE} = \frac{DE}{DE}$ (ratio of corr. sides of similar $\Delta$ s)		
	AF $BF9+FF$ 195	M1	
	$\frac{3+ET}{0} = \frac{13.5}{13}$		
Q	11107329 21 COM		
O	$EF = 9 \times \frac{2}{2} - 9$		
	= 4.5  cm	41	Penalise units
	OR	AI	I chanse units
	$\frac{AF}{2} = \frac{2}{2}$		
	AE 3		
	$\frac{9}{2} = \frac{2}{2}$		
	AE  3	N/1	Denote 110 EE 12.5
	AE = 13.5  cm	IVII	Do not award II $EF = 13.5$ cm
	LF = AL - AF $= 13.5 - 9$		
	= 4.5  cm	A1	Penalise units
(c)	$\angle BCD = \angle BFA = 63^{\circ} (\text{corr. } \angle s \text{ of similar } \Delta)$	B1	Penalise presentation for
	$\angle DBF = \angle BDC + \angle BCD \text{ (ext. } \angle = \text{ sum of int. opp. } \angle \text{)}$		missing reasons or if points
	$=75^{\circ}+63^{\circ}$		doesn't correspond correctly
	=138 <sup>-</sup>	RI BI	Penalise units
	$\angle BAF = \angle BDC = 75^{\circ} \text{ (corr. } \angle s \text{ of similar } \Delta \text{)}$	B1	
L			L

	$\angle DBF = \angle BAF + \angle BFA \text{ (ext. } \angle = \text{sum of int. opp. } \angle \text{)}$		
	$= 138^{\circ}$	B1	Penalise units
6	Volume and Surface Area of Pyramids, Cones and	5	
	Spheres		
(a)	Volume of remaining solid = $\frac{1}{\pi r_{i}^{2}}$ , $h - \frac{1}{\pi r_{i}^{2}}$ , $h$		
	3 <sup>rarge</sup> 3 <sup>small</sup>		Award M1 if correctly find any
	$=\frac{1}{2}\pi(9^2)(12)-\frac{1}{2}\pi(5^2)(12)$	M1	of the cone volume
	$\frac{3}{-324\pi}$ -100 $\pi$		Do not award A1 if answer not
	$= 324\pi - 100\pi$ = $224\pi \text{ cm}^3$	A1	in terms of $\pi$
(h)	Total surface area of remaining solid		Penalise units
	= large curved surface + small curved surface + ring base		Award M1 each if correctly find
	$=\pi r_{lorg} l_{lorg} + \pi r_{max} l_{max} + (\pi r_{lorg}^2 - \pi r_{max}^2)$	M1	any of the curved surface and
	$-\pi(9)(15) + \pi(5)(13) + (\pi 9^2 - \pi 5^2)$	M1	ring base
	$= 135\pi + 65\pi + 81\pi - 25\pi$		Do not award A1 if answer not
	$= 256\pi \text{ cm}^2$	A1	In terms of $\pi$ Penalise units
7	Pythagoras' Theorem and Volume and Surface Area of	6	
	Pyramids, Cones and Spheres		
(a)	By Pythagoras' Theorem,		Penalise presentation if did not
	$MX^2 = OX^2 + MO^2$		write 'Pythagoras' Theorem'
	$125^2 = OX^2 + (\frac{150}{2})^2$	M1	y Kaki.Culli
	$OY^2 = 125^2 - 75^2$		
	$OX^2 = 120 = 75$ $OX^2 = 10000$		
	$QX = \pm \sqrt{10000}$		Penalise presentation if did not
	OX = 100 cm (reject -100)	A1	Include $\pm$ and reject $-ve$ Penalise units
	OR		i chunse units
	By Pythagoras' Theorem,		Penalise presentation if did not
	$NX^2 = OX^2 + NO^2$		write 'Pythagoras' Theorem'
	$145^2 = OX^2 + (\frac{210}{2})^2$		
G	$QY^2 = 145^2$ 105 <sup>2</sup>		
	OX = 145 - 105 $OX^2 - 10000$		
	$OX = +\sqrt{10000}$		Penalise presentation if did not
	OX = 100 cm (reject $-100$ )		Penalise units
(b)	Volume of text = 1 here ever /		
	Volume of tent $-\frac{1}{3} \times \text{base area } \times h$		
	$=\frac{1}{2} \times (210)(150) \times 100$	M1	e.c.f. of OX
	3	A1	Penalise units
(c)	$= 1050000 \text{ cm}^3$		
	= 2 × lateral face $ABX$ + 2 × lateral face $BCX$ + hase		
	$= 2 \times \frac{1}{2} (210)(125) + 2 \times \frac{1}{2} (150)(145) + (210)(150)$	M1	Award M1 if correctly find any
	$= 2 \frac{10}{2} (210)(120) + 2 \frac{10}{2} (150)(140) + (210)(150)$		of the lateral face area
	$= 79500 \text{ cm}^2$	A1	Penalise units
8	Pythagoras' Theorem and Trigonometric Ratios	11	

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(a)	$DE^2 = 100^2$		Do not award if equate
()	= 10000		$DE^2 = CD^2 + CE^2$ from the
	$CD^2 + CF^2 = 28^2 + 96^2$		start
	= 10000	M1	Do not award M1 if did not
	As $DE^2 = CD^2 + CE^2$ , by the converse of Pythagoras'		show both calculations
	Theorem triangle $CDE$ is a right-angled triangle.	A1	Do not award A1 if did not
	Theorem, mangre CDD is a right angrea changer.		mention 'converse of
			Pythagoras' Theorem'
			Award 1m only if didn't write
			$DE^2$ and $CD^2 + CE^2$ .
(b)	Let the shortest distance from $C$ to $DE$ be $x$ .		
	$\frac{1}{2} \times DE \times x = \frac{1}{2} \times CD \times CE$		
	2 2 2		
	$\frac{1}{1} \times 100 \times r = \frac{1}{1} \times 28 \times 96$	MI	
	$\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$ $\frac{1}{2}$	1911	
	$= 28 \times 96$		
	$x = \frac{100}{100}$		
	= 26.88  cm	A1	Penalise units and accuracy
	OR		
	$\sin \angle CDE - \frac{CE}{CE}$		
	$\sin 2CDE = \frac{1}{DE}$		
	$\sin \langle CDE = 96$	1101	zkaki com
	$\sin 2CDE = \frac{100}{100}$	M1	Award using equivalent ratios
	$(CDE - \sin^{-1}(96))$		$\cos \angle CDE = \frac{CD}{28} = \frac{28}{28}$ or
	$\angle CDL = SIII \left(\frac{100}{100}\right)$		DE = 100
	$= 73.7^{\circ} (1 dp)$		$\tan \angle CDE = \frac{CE}{CE} = \frac{96}{96}$
	Let the shortest distance from $C$ to $DE$ be $x$ .		CD = 28
	$\sin \angle CDE = \frac{x}{1-x}$		or find $\angle CED$ (refer to (d))
	CD		$\sin \angle CED = \frac{x}{x}$
	$x = CD \times \sin \angle CDE$		CE
	$= 28 \times \sin(73.740)$		
	$-28 \times \frac{96}{100}$		
	UU <sup>20</sup> 0100 Karkl.COIII		
	= 26.9  cm (3  sf)	A1	Penalise units and accuracy
(c)	$\cos \langle AED - \frac{AE}{\Delta E} \rangle$		
	$\frac{1}{DE}$		
	$\cos\left(4ED-60\right)$	3.44	
	$\cos \angle AED = \frac{100}{100}$	MI	
	(177)		
	$\angle AED = \cos^{-1}(\frac{100}{100})$		
	= 53.1° (1dp)	A1	Penalise units and accuracy
(d)	$\sin \langle CED - \frac{CD}{2} \rangle$		
	$\sin 2 CED = \frac{1}{DE}$		
	$\sin \langle CED - \frac{28}{28} \rangle$		
	$\int \sin 2C LD = \frac{100}{100}$		Award using equivalent ratios $CE = 06$
	$(CED - circ^{-1}(28))$		$\cos \angle CED = \frac{CE}{DR} = \frac{96}{100}$ or
	$2CED = \sin^{-1}\left(\frac{100}{100}\right)$		DE = 100
	$= 16.3^{\circ} (1 dp)$	M1	$\tan \angle CED = \frac{CD}{2} = \frac{28}{2}$
	$\angle AEC = \angle AED - \angle CED$		<i>CE</i> 96

	$=\cos^{-1}(\frac{60}{1-1})-\sin^{-1}(\frac{28}{1-1})$		e.c.f. of $\angle AED$
			Penalise units and accuracy
	= 53.130 - 16.260 = 36.0° (1dm)	A1	using rounded off values
(e)	-30.9 (10p)		
	$\tan \angle AEB = \frac{1}{AE}$		
	$AB = AE \times \tan \angle AEB$		
	$= 60 \times \tan[\cos^{-1}(\frac{60}{100}) - \sin^{-1}(\frac{28}{100})]$	M1	e.c.f. of $\angle AEB$
	$= 60 \times \tan[53.130 - 16.260]$		
	$= 60 \times \tan[36.870]$		
	= 45  cm	A1	Penalise units
9	<b>Quadratic Functions, Graphs and Equations</b>	7	
(a)	$h = -5t^2 + 8t + 16.8$		
	$h = -5(2.4)^2 + 8(2.4) + 16.8$		
	h = 7.2	B1	
(b)		B1	1m for axes
		<b>B</b> 1	1m for points plotted correctly
		<b>B</b> 1	1m for curve drawn smoothly
			e.c.f. of calculated point
			Penalise presentation if
(c)	Turning point: (0.8, 20)	B1	Do not award without brackets
(i)		21	Do not award without blackets
(c)	Line of symmetry: $t = 0.8$	B1	Penalise presentation if did not
(ii)			draw line of symmetry
			Penalise presentation if write
	$0.16 \circ (0.0000000000000000000000000000000000$	D1	x = 0.8
(C) (iii	0.10 s (accept 0.12 to 0.20) and 1.44 s (accept 1.40 to 1.48)	BI	Penalise presentation if did not
			e c f of graph drawn
			Do not award if never include
			all values in given domain
C	luuy kaki.cuii		Penalise units
10	Congruence and Similarity and Proportion	10	
(a)	3 cm : 3 m		
	3 cm : 300 cm		
	4  cm : 400  cm		
	1 cm : 100 cm		
	1:100	<b>B</b> 1	
(b)	$c \propto w^2$		
(i)	Let $c = kw^2$ , where k is a constant,		
	When $c = 14.4$ , $w = 60$	100 5000	
	$14.4 = k(60)^2$	M1	Award M1 if correctly
	$k = \frac{14.4}{1}$		substitute
	$\kappa - \frac{1}{60^2}$		
	k = 0.004		Do not award A1 if c is not
	$\therefore c = 0.004 w^2$	A1	subject

(b)	When $w = 90$ ,		
(ii)	$c = (0.004)(90)^2$		e.c.f. of equation
	r = \$32.40	<b>B</b> 1	Penalise units and accuracy
(c)	1 cm : 100 cm		e.c.f. of map scale
(i)	1 cm : 1 m		
	$(1)^2 \text{ cm}^2 : (1)^2 \text{ m}^2$		
	$1 \text{ cm}^2 : 1 \text{ m}^2$	M1	
	Actual area of kitchen = $14.6 \text{ m}^2$		
	Cost of kitchen laminate = $14.6 \times 80$		
	= \$1168	A1	Penalise units
(c)	Cost of living room cement screed = $5.5 \times 3 \times 250$	<b>B</b> 1	e.c.f. of map scale
(ii)	= \$4125		for each measurement, accept
	Cost of bedrooms vinyl = $8.2 \times 3 \times 60$	<b>B1</b>	$\pm 0.1$ cm uncertainty
	= \$1476		
	Cost of bathrooms ceramic tiles = $2.4 \times 1.8 \times (40 + 70)$	<b>B1</b>	
	= \$475.20		
	$Total \cos t = 1168 + 4125 + 1476 + 475.20$		
	= \$7244.20		
	Mr Tan should set aside \$7500 for his floor renovation.	<b>B</b> 1	
			Penalise units
			Accept any unrounded or
		1	rounded amount based on
	ST		students' calculations (e.g.
			\$8000, \$10000)
			Do not award if statement does
			not come with calculations

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