



BEDOK SOUTH SECONDARY SCHOOL END-OF-YEAR EXAMINATION 2023

2EXP

CANDIDATE
NAME

CLASS

INDEX
NUMBER

MATHEMATICS PAPER 1

4052/01

9 October 2023

Candidates answer on the Question Booklet.

1 hour

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**.

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

2

Answer **all** the questions.

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

Answer [2]

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

Answer [2]

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

Answer [2]

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

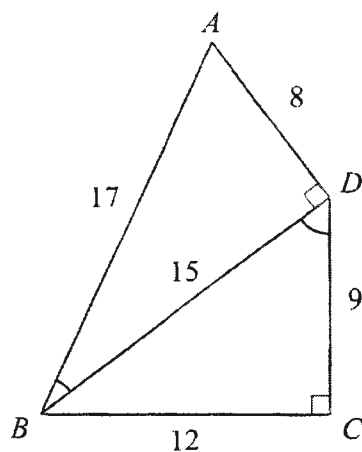
Answer [2]

3

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

Answer [2]

- 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.



Find, in fractions in its simplest form, the values of

- (a) $\sin \angle BDC$,

Answer [1]

- (b) $\tan \angle ABD$.

Answer [1]

4

- 7 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

.....
 [2]

- 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 $q = 4$.

Answer [3]

5

Tuition
with
Jason

- 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.

Answer [1]

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

Answer [1]

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

Answer

.....
..... [1]

6

- 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

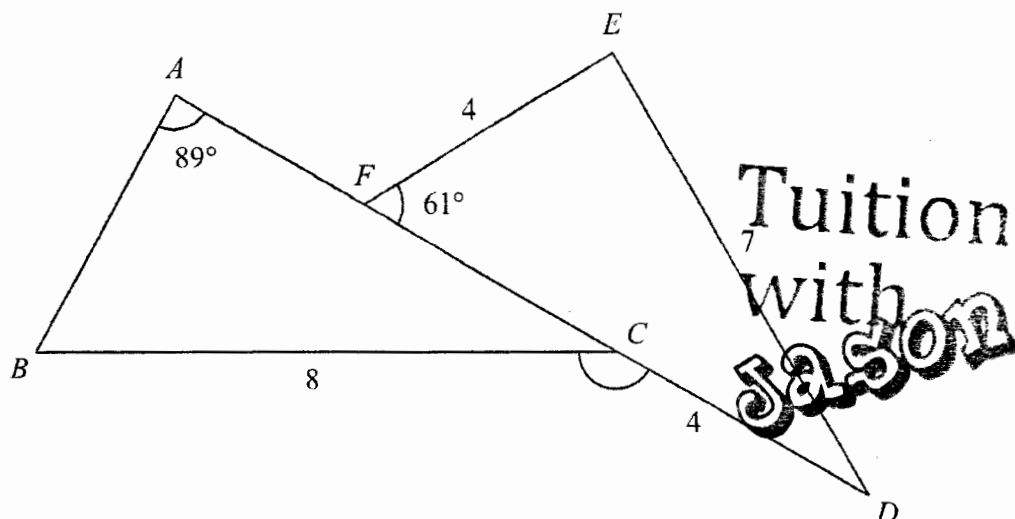
[1]

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

Answer [3]

7

- 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.



Calculate

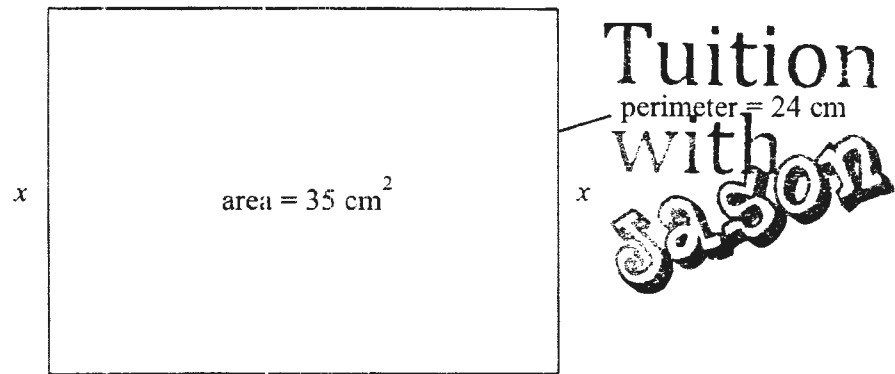
- (a) $\angle BCD$,

Answer [2]

- (b) AF .

Answer [3]

- 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 cm^2 .

Answer [1]

- (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 $(12 - x) \text{ cm}$.

Answer

[1]

- (c) 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

[1]

9

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

Answer: Length of shorter side =

Length of longer side = [3]

10

- 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]

- (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

[1]

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

Answer [3]

End of Paper



BEDOK SOUTH SECONDARY SCHOOL END-OF-YEAR EXAMINATION 2023

2EXP

CANDIDATE
NAME

CLASS

INDEX
NUMBER

MATHEMATICS PAPER 2

4052/02

2 October 2023

Candidates answer on the Question Booklet.

1 hour 30 minutes

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 **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 π , use your calculator value or 3.142.

Examiner's Use			
Penalty	Question No.		Mark -1 / -2
Units			
Accuracy			
Presentation			
Sub-Total		Total	60

Answer **all** the questions.

- 1 It is given that $p = \frac{q-1}{q-r}$.

(a) Find p when $q = 7$ and $r = 4$.

Answer [1]

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

Answer [2]

- 2 Solve the following pair of simultaneous equations.

$$\begin{aligned} 3x - 2y &= 5 \\ 6x + 9y &= -16 \end{aligned}$$

Answer [3]

- 3 The masses of some newborn babies born in a hospital are shown in the grouped frequency table.

Mass (kg)	Frequency
$2.0 \leq m < 2.5$	4
$2.5 \leq m < 3.0$	x
$3.0 \leq m < 3.5$	19
$3.5 \leq m < 4.0$	12
$4.0 \leq m < 4.5$	4

- (a) Find the largest possible value of x if
 (i) the modal class interval is $3.0 \leq m < 3.5$.

Answer [1]

- (ii) the median lies in the class interval $3.0 \leq m < 3.5$,

Answer [1]

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

Answer [2]

- (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]

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

$$T_1 = 1^2 + 1 = 2$$

$$T_2 = 2^2 + 2 = 6$$

$$T_3 = 3^2 + 3 = 12$$

$$T_4 = 4^2 + 4 = 20$$

$$T_5 = 5^2 + 5 = 30$$

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

Answer [1]

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

Answer [2]

- (c) Explain why the value of T_n must be even for all values of n .

Answer

.....

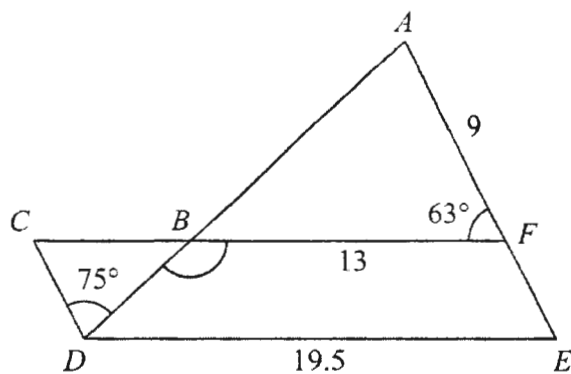
 [1]

- (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 n th term of the new sequence.

Answer [1]

- 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 $AF : AE$,

Answer [1]

- (b) EF ,

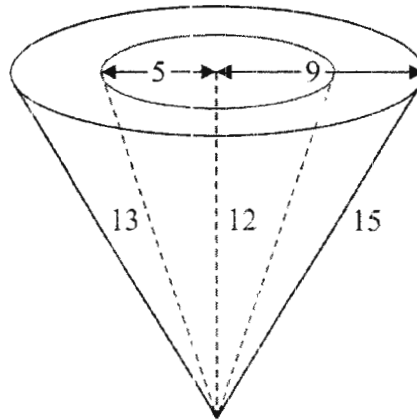
Answer [2]

- (c) $\angle DBF$.

Answer [2]

Tuition
with
Jason

- 6 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 π** , for

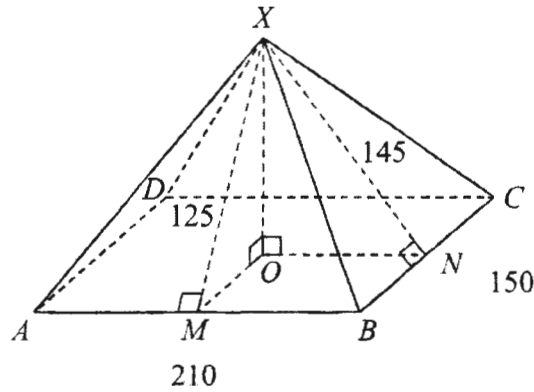
- (a) the volume of the remaining solid,

Answer [2]

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

Answer [3]

- 7 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

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

Answer [2]

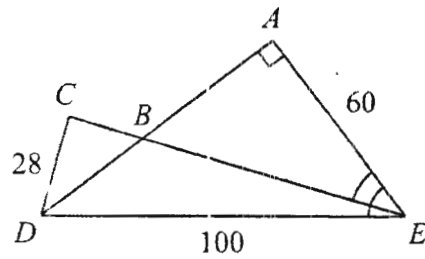
- (b) the volume of the tent,

Answer [2]

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

Answer [2]

- 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

.....
 [2]

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

Answer [2]

- (c) Calculate $\angle AED$.

Answer [2]

(d) Calculate $\angle AEC$.

Answer [3]

(e) Calculate AB .

Answer [2]

- 9 A pebble is thrown from a cliff into the sea.
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
h/m	16.8	19.2	20.0	19.2	16.8	12.8	p	0.0

- (a) Find the value of p .

Answer [1]

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

[3]

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

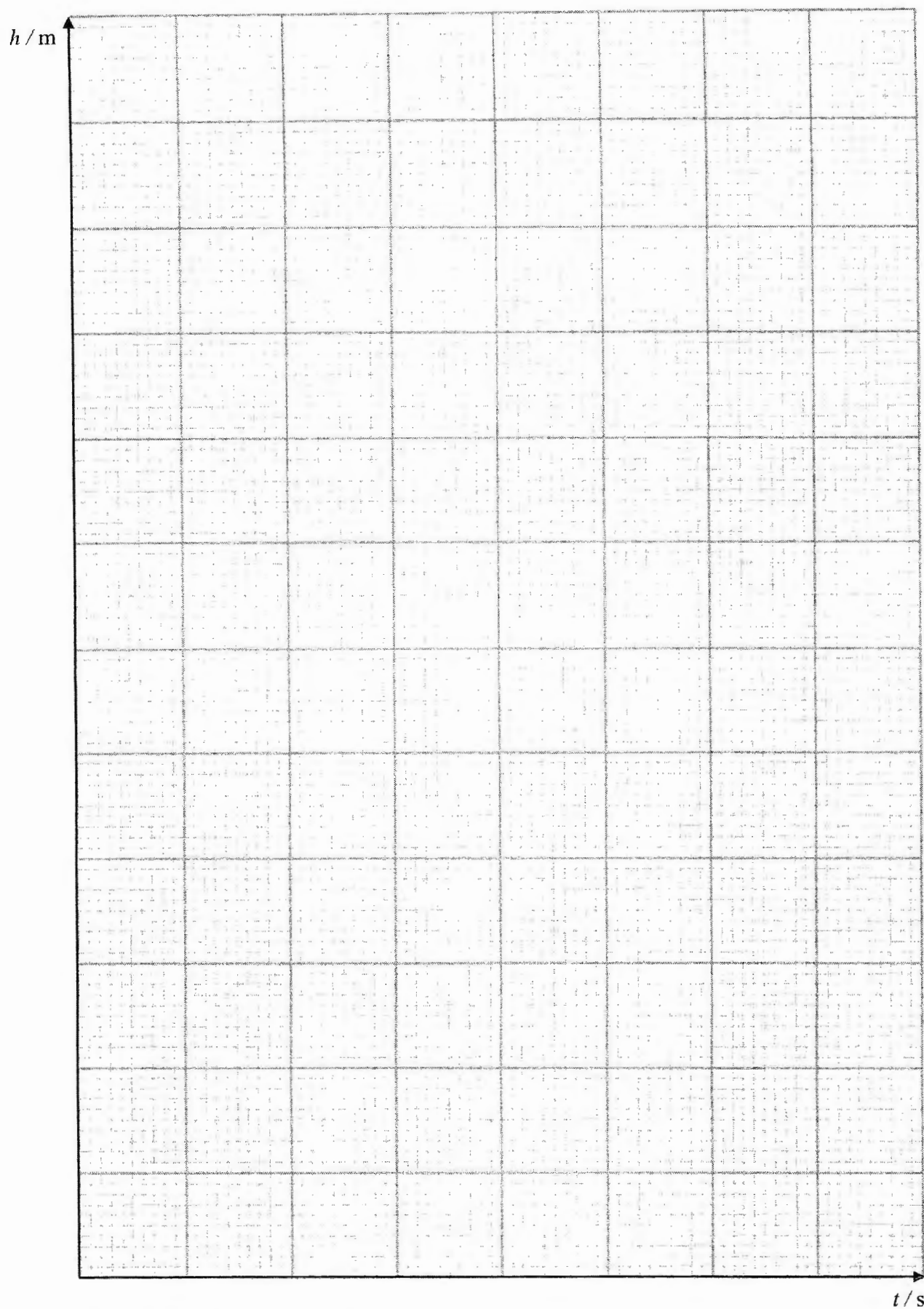
Answer [1]

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

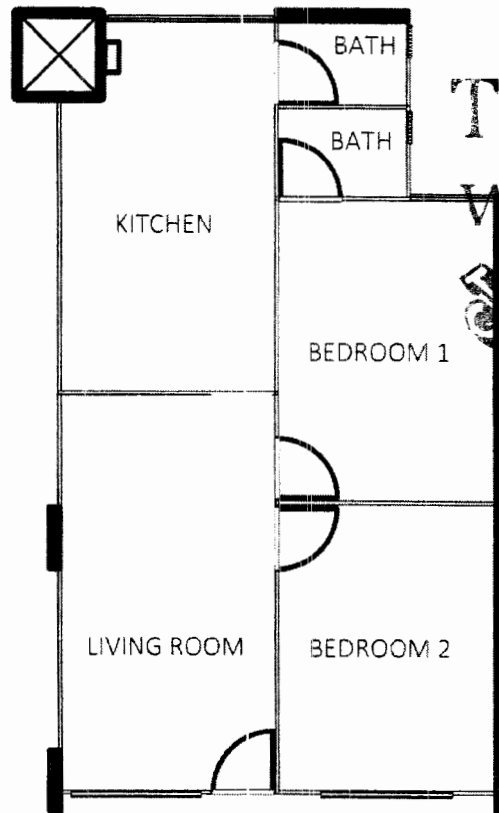
Answer [1]

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

Answer [1]



- 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 .

Answer [1]

15

- (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 .

Answer [2]

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

Answer [1]

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 flooring options

Flooring material	Material cost per m ²	Labour cost per m ²
Cement screed	\$250 including labour	
Ceramic tiles	\$40	\$70
Laminate	\$80 including labour	
Marble	\$600	\$120
Parquet	\$500 including labour	
Vinyl	\$60 including labour	

16

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

Answer [2]

- (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

.....
..... [4]

End of Paper

EM2 EOY 2023 PAPER 1 MARKING SCHEME

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

	Since $a\sqrt{b+1} = 12$ for the values given in table, a is inversely proportional to $\sqrt{b+1}$.	A1	Do not accept if only check 2 pairs of values
8	Proportion	3	
	$p \propto q^2$ Let $p = kq^2$, where k is a constant, When $q = 2$, $p = k2^2$ $p = 4k$ When $q = 3$, $p = k3^2$ $p = 9k$ $4k + 9k = 26$ $13k = 26$ $k = 2$ $\therefore p = 2q^2$ When $q = 4$, $p = (2)4^2$ $p = 32$	M1 M1 A1	Award M1 if correctly form equation Award M1 if correctly find k
9	Statistical Diagrams and Measures of Central Tendency	3	
(a)	$\frac{10+x+14}{2} = 12.5$ $x+24 = 2 \times 12.5$ $x = 25 - 24$ $x = 1$	B1	
(b)	Number of students scored more than $y = \frac{2}{5} \times 10$ $= 4$ students $y = 14$ marks	B1	
(c)	Mean can be affected by outlier/extreme values.	B1	
10	Linear Inequalities	4	
(a)	$8(20-x)$ $= 160 - 8x$ (shown)	B1	
(b)	$160 - 8x \geq 6 \times 20$ $160 - 8x \geq 120$ $160 - 120 \geq 8x$ $8x \leq 40$ $x \leq 5$ $\therefore$ Wendy did not make a loss if the maximum number of strawberries boxes spoilt is 5.	M1 M1 A1	Do not award M1 if $>$ instead of $\geq$ Do not award if did not form and solve inequality
11	Congruence and Similarity	5	
(a)	$\angle ABC = \angle EFD = 61^\circ$ (corr. $\angle$ s of $\equiv \Delta$) $\angle BCD = \angle ABC + \angle BAC$ (ext. $\angle$ = sum of int. opp. $\angle$) $= 61^\circ + 89^\circ$ $= 150^\circ$	B1 B1	Penalise presentation for missing reasons or if points doesn't correspond correctly Penalise units
(b)	$FD = BC = 8\text{ cm}$ (corr. sides of $\equiv \Delta$) $FC = FD - CD$ $= 8 - 4$ $= 4\text{ cm}$ $AC = ED = 7\text{ cm}$ (corr. sides of $\equiv \Delta$)	B1 B1	Penalise presentation for missing reasons or if points doesn't correspond correctly

	$AF = AC - FC$ $= 7 - 4$ $= 3 \text{ cm}$	B1	Penalise units
12	Quadratic Functions, Graphs and Equations	6	
(a)	$\frac{35}{x} \text{ cm}$	B1	Penalise units
(b)	$\frac{24-2x}{2} = \frac{24}{2} - x = (12-x) \text{ cm (shown)}$	B1	
(c)	$\frac{35}{x} = 12 - x$ $35 = 12x - x^2$ $x^2 - 12x + 35 = 0 \text{ (shown)}$	B1	
(d)	$x^2 - 12x + 35 = 0$ $(x-5)(x-7) = 0$ $x-5 = 0 \quad \text{or} \quad x-7 = 0$ $x = 5 \quad \text{or} \quad x = 7$ Shorter side = 5 cm, longer side = $12-5$ or $\frac{35}{5} = 7 \text{ cm}$	M1 M1 A1	Do not award if did not equate to 0 Penalise presentation if did not write 'or' Penalise units
13	Linear Equations in Two Variables	5	
(a)	$10x + y = 4(x + y)$ $10x + y = 4x + 4y$ $6x - 3y = 0$ $2x - y = 0 \text{ (shown)}$	B1	
(b)	$10x + y = 10y + x - 9$ $9x - 9y = -9$ $x - y = -1 \text{ (shown)}$	B1	
(c)	$2x - y = 0 \text{ -----(1)}$ $x - y = -1 \text{ -----(2)}$ $(1) - (2)$ $(2x - y) - (x - y) = (0) - (-1)$ $2x - y - x + y = 1$ $x = 1$ Sub $x = 1$ into (1) $2(1) - y = 0$ $y = 2$ The two-digit number is 12.	M1 B1 A1	Do not award if used their 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

EM2 EOY 2023 PAPER 2 MARKING SCHEME

Qn	Solutions	Marks	Remarks
1	Algebraic Fractions and Formulae	3	
(a)	$p = \frac{q-1}{q-r}$ $p = \frac{7-1}{7-4}$ $p = \frac{6}{3}$ $p = 2$	B1	
(b)	$p = \frac{q-1}{q-r}$ $p(q-r) = q-1$ $pq - pr = q-1$ $pq - q = pr - 1$ $q(p-1) = pr - 1$ $q = \frac{pr-1}{p-1} \quad \text{or} \quad q = \frac{1-pr}{1-p}$	M1 A1	Award M1 if correctly linearise formula Do not award A1 if only write $\frac{pr-1}{p-1}$ in answer blank without $q =$
2	Linear Equations in Two Variables	3	
	$3x - 2y = 5$ -----(1) $6x + 9y = -16$ -----(2) $(1) \times 2$ $6x - 4y = 10$ -----(3) $(2) - (3)$ $(6x + 9y) - (6x - 4y) = (-16) - (10)$ $6x + 9y - 6x + 4y = -16 - 10$ $13y = -26$ $y = -2$ Sub $y = -2$ into (3) $3x - 2(-2) = 5$ $3x + 4 = 5$ $3x = 1$ $x = \frac{1}{3}$ $\therefore x = \frac{1}{3}, y = -2$	M1 A1	Do not accept guess and check Award M1 for correct elimination or substitution to form equation with one variable Award A1 for each correct solution found
3	Measures of Central Tendency	5	
(a)	$x = 18$	B1	
(i)			
(a)	$4 + x = (19 - 1) + 12 + 4$		
(ii)	$x = 18 + 16 - 4$ $x = 30$	B1	
(b)	Estimate of the mean $= \frac{4 \times 2.25 + 11 \times 2.75 + 19 \times 3.25 + 12 \times 3.75 + 4 \times 4.25}{4 + 11 + 19 + 12 + 4}$	M1	

	$\begin{aligned} &= \frac{163}{50} \\ &= 3.26 \text{ kg} \end{aligned}$	A1	Penalise units
(c)	The estimate of the mean mass will decrease by 0.5 kg after the error is corrected.	B1	Do not accept if did not specify decrease by 0.5 kg
4	Number Patterns and Quadratic Functions, Graphs and Equations	5	
(a)	$T_n = n^2 + n$	B1	Accept $T_n = n(n+1)$
(b)	$\begin{aligned} n^2 + n &= 72 \\ n^2 + n - 72 &= 0 \\ (n-8)(n+9) &= 0 \\ n-8 &= 0 \quad \text{or} \quad n+9 = 0 \\ n &= 8 \quad \text{or} \quad n = -9 \text{ (reject)} \end{aligned}$	M1 A1	e.c.f. of general term Penalise presentation if did not write 'or's
(c)	When n is odd, n^2 will also be odd and their sum will be even. When n is even, n^2 will also be even and their sum will be even. OR When n is odd, $n+1$ will be even and their product will be even. When n is even, $n+1$ will be odd and their product will be even.	B1 B1	
(d)	$T_n = n^2 + n - 1$	B1	e.c.f. of general term of above sequence
5	Congruence and Similarity	5	
(a)	$\begin{aligned} AF &: AE \\ BF &: DE \\ 13 &: 19.5 \\ 2 &: 3 \end{aligned}$	B1	
(b)	$\begin{aligned} \triangle ABF \text{ is similar to } \triangle ADE. \\ \frac{AF + EF}{AF} &= \frac{DE}{BF} \text{ (ratio of corr. sides of similar } \triangle \text{s)} \\ \frac{9 + EF}{9} &= \frac{19.5}{13} \\ EF &= 9 \times \frac{3}{2} - 9 \\ &= 4.5 \text{ cm} \end{aligned}$ OR $\begin{aligned} \frac{AF}{AE} &= \frac{2}{3} \\ \frac{9}{AE} &= \frac{2}{3} \\ AE &= 13.5 \text{ cm} \\ EF &= AE - AF \\ &= 13.5 - 9 \\ &= 4.5 \text{ cm} \end{aligned}$	M1 A1 M1 A1	 Penalise units Do not award if $EF = 13.5 \text{ cm}$ Penalise units
(c)	$\begin{aligned} \angle BCD &= \angle BFA = 63^\circ \text{ (corr. } \angle \text{s of similar } \triangle) \\ \angle DBF &= \angle BDC + \angle BCD \text{ (ext. } \angle = \text{sum of int. opp. } \angle) \\ &= 75^\circ + 63^\circ \\ &= 138^\circ \end{aligned}$ OR $\angle BAF = \angle BDC = 75^\circ \text{ (corr. } \angle \text{s of similar } \triangle)$	B1 B1 B1	Penalise presentation for missing reasons or if points doesn't correspond correctly Penalise units

	$\angle DBF = \angle BAF + \angle BFA$ (ext. $\angle$ = sum of int. opp. $\angle$) $= 75^\circ + 63^\circ$ $= 138^\circ$	B1	Penalise units
6	Volume and Surface Area of Pyramids, Cones and Spheres	5	
(a)	Volume of remaining solid $= \frac{1}{3} \pi r_{large}^2 h - \frac{1}{3} \pi r_{small}^2 h$ $= \frac{1}{3} \pi (9^2)(12) - \frac{1}{3} \pi (5^2)(12)$ $= 324\pi - 100\pi$ $= 224\pi \text{ cm}^3$	M1 A1	Award M1 if correctly find any of the cone volume Do not award A1 if answer not in terms of π Penalise units
(b)	Total surface area of remaining solid $=$ large curved surface + small curved surface + ring base $= \pi r_{large} l_{large} + \pi r_{small} l_{small} + (\pi r_{large}^2 - \pi r_{small}^2)$ $= \pi(9)(15) + \pi(5)(13) + (\pi 9^2 - \pi 5^2)$ $= 135\pi + 65\pi + 81\pi - 25\pi$ $= 256\pi \text{ cm}^2$	M1 M1 A1	Award M1 each if correctly find any of the curved surface and ring base Do not award A1 if answer not in terms of π Penalise units
7	Pythagoras' Theorem and Volume and Surface Area of Pyramids, Cones and Spheres	6	
(a)	By Pythagoras' Theorem, $MX^2 = OX^2 + MO^2$ $125^2 = OX^2 + \left(\frac{150}{2}\right)^2$ $OX^2 = 125^2 - 75^2$ $OX^2 = 10000$ $OX = \pm\sqrt{10000}$ $OX = 100 \text{ cm}$ (reject -100) OR By Pythagoras' Theorem, $NX^2 = OX^2 + NO^2$ $145^2 = OX^2 + \left(\frac{210}{2}\right)^2$ $OX^2 = 145^2 - 105^2$ $OX^2 = 10000$ $OX = \pm\sqrt{10000}$ $OX = 100 \text{ cm}$ (reject -100)	M1 A1	Penalise presentation if did not write 'Pythagoras' Theorem' Penalise presentation if did not include $\pm$ and reject -ve Penalise units Penalise presentation if did not write 'Pythagoras' Theorem' Penalise presentation if did not include $\pm$ and reject -ve Penalise units
(b)	Volume of tent $= \frac{1}{3} \times \text{base area} \times h$ $= \frac{1}{3} \times (210)(150) \times 100$ $= 1\,050\,000 \text{ cm}^3$	M1 A1	e.c.f. of OX Penalise units
(c)	Total surface area of tent $= 2 \times \text{lateral face } ABX + 2 \times \text{lateral face } BCX + \text{base}$ $= 2 \times \frac{1}{2} (210)(125) + 2 \times \frac{1}{2} (150)(145) + (210)(150)$ $= 79\,500 \text{ cm}^2$	M1 A1	Award M1 if correctly find any of the lateral face area Penalise units
8	Pythagoras' Theorem and Trigonometric Ratios	11	

(a)	$DE^2 = 100^2$ $= 10000$ $CD^2 + CE^2 = 28^2 + 96^2$ $= 10000$ As $DE^2 = CD^2 + CE^2$, by the converse of Pythagoras' Theorem, triangle CDE is a right-angled triangle.	M1 A1	Do not award if equate $DE^2 = CD^2 + CE^2$ from the start Do not award M1 if did not show both calculations Do not award A1 if did not 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. $\frac{1}{2} \times DE \times x = \frac{1}{2} \times CD \times CE$ $\frac{1}{2} \times 100 \times x = \frac{1}{2} \times 28 \times 96$ $x = \frac{28 \times 96}{100}$ $= 26.88 \text{ cm}$ OR $\sin \angle CDE = \frac{CE}{DE}$ $\sin \angle CDE = \frac{96}{100}$ $\angle CDE = \sin^{-1}\left(\frac{96}{100}\right)$ $= 73.7^\circ \text{ (1dp)}$ Let the shortest distance from C to DE be x. $\sin \angle CDE = \frac{x}{CD}$ $x = CD \times \sin \angle CDE$ $= 28 \times \sin(73.740)$ $= 28 \times \frac{96}{100}$ $= 26.9 \text{ cm (3sf)}$	M1 A1 M1 A1	Penalise units and accuracy Award using equivalent ratios $\cos \angle CDE = \frac{CD}{DE} = \frac{28}{100} \quad \text{or}$ $\tan \angle CDE = \frac{CE}{CD} = \frac{96}{28}$ or find $\angle CED$ (refer to (d)) $\sin \angle CED = \frac{x}{CE}$ Penalise units and accuracy
(c)	$\cos \angle AED = \frac{AE}{DE}$ $\cos \angle AED = \frac{60}{100}$ $\angle AED = \cos^{-1}\left(\frac{60}{100}\right)$ $= 53.1^\circ \text{ (1dp)}$	M1 A1	Penalise units and accuracy
(d)	$\sin \angle CED = \frac{CD}{DE}$ $\sin \angle CED = \frac{28}{100}$ $\angle CED = \sin^{-1}\left(\frac{28}{100}\right)$ $= 16.3^\circ \text{ (1dp)}$ $\angle AEC = \angle AED - \angle CED$	M1 M1	Award using equivalent ratios $\cos \angle CED = \frac{CE}{DE} = \frac{96}{100} \quad \text{or}$ $\tan \angle CED = \frac{CD}{CE} = \frac{28}{96}$

	$= \cos^{-1}\left(\frac{60}{100}\right) - \sin^{-1}\left(\frac{28}{100}\right)$ $= 53.130 - 16.260$ $= 36.9^\circ \text{ (1dp)}$	A1	e.c.f. of $\angle AED$ Penalise units and accuracy Penalise accuracy if 36.8° for using rounded off values
(e)	$\tan \angle AEB = \frac{AB}{AE}$ $AB = AE \times \tan \angle AEB$ $= 60 \times \tan\left[\cos^{-1}\left(\frac{60}{100}\right) - \sin^{-1}\left(\frac{28}{100}\right)\right]$ $= 60 \times \tan[53.130 - 16.260]$ $= 60 \times \tan[36.870]$ $= 45 \text{ cm}$	M1 A1	e.c.f. of $\angle AEB$ Penalise units
9	Quadratic Functions, Graphs and Equations	7	
(a)	$h = -5t^2 + 8t + 16.8$ $h = -5(2.4)^2 + 8(2.4) + 16.8$ $h = 7.2$	B1	
(b)		B1 B1 B1	1m for axes 1m for points plotted correctly 1m for curve drawn smoothly e.c.f. of calculated point Penalise presentation if - never label equation
(c) (i)	Turning point: (0.8, 20)	B1	Do not award without brackets
(c) (ii)	Line of symmetry: $t = 0.8$	B1	Penalise presentation if did not draw line of symmetry Penalise presentation if write $x = 0.8$
(c) (iii)	0.16 s (accept 0.12 to 0.20) and 1.44 s (accept 1.40 to 1.48)	B1	Penalise presentation if did not draw dotted line working e.c.f. of graph drawn Do not award if never include all values in given domain Penalise units
10	Congruence and Similarity and Proportion	10	
(a)	3 cm : 3 m 3 cm : 300 cm 4 cm : 4 m 4 cm : 400 cm 1 cm : 100 cm 1 : 100	B1	
(b) (i)	$c \propto w^2$ Let $c = kw^2$, where k is a constant, When $c = 14.4$, $w = 60$ $14.4 = k(60)^2$ $k = \frac{14.4}{60^2}$ $k = 0.004$ $\therefore c = 0.004w^2$	M1 A1	Award M1 if correctly substitute Do not award A1 if c is not subject

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

