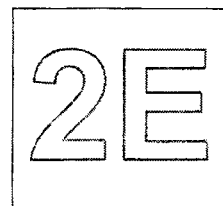




**CANBERRA SECONDARY SCHOOL**

**2023 End-of-Year Examination**

**Secondary Two Express**



**MATHEMATICS**

Paper 1

9 October 2023  
1 hour 15 minutes  
1020h – 1135h

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

**READ THESE INSTRUCTIONS FIRST**

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

Write in dark blue or black ink pen on both sides of the paper.

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  $\pi$ .

At the end of the examination, fasten all your work securely together.

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

The total of the marks for this paper is 50.

| FOR MARKER'S USE |                  |              |
|------------------|------------------|--------------|
|                  | Marks<br>Awarded | Max<br>Marks |
| Total            |                  | 50           |

2

- 1 Simplify  $4a(b+c)-3b(a-7c)$ .

Answer ..... [2]

---

- 2 Factorise  $12a^2 - 75$ .

Answer ..... [2]

---

- 3 A triangle has sides  $AB = 8$  cm,  $BC = 15$  cm and  $AC = 17$  cm.

- (a) Explain why triangle  $ABC$  is a right-angled triangle.

Answer ..... [2]

- (b) Calculate  $\angle ACB$

Answer ..... [2]

---

3

Tuition  
with  
Jason

- 4 A bag contains 5 red marbles, 6 green marbles and 3 yellow marbles. Matilda draws a marble at random.

(a) Find the probability that a green marble is drawn.

Answer ..... [1]

(b) Find the probability that the marble drawn is not red.

Answer ..... [1]

(c) If Calos adds 3 blue marbles into the bag, find the probability that Matilda draws out a blue marble.

Answer ..... [1]

- 5 Given that a sphere has a volume of  $700 \text{ cm}^3$  and a cube has a volume of  $729 \text{ cm}^3$ .

Explain, with calculations, why even though the sphere has a smaller volume compared to the cube, the sphere cannot fit inside the cube.

Answer

[4]

- 6 The stem and leaf diagram below states the data collected on the scores of two classes during a Mathematics test.

| Class A     | Stem | Class B   |
|-------------|------|-----------|
| 1 5 4 9     | 0    | 2 4 4     |
|             | 1    | 2 5 8 8 9 |
| 0 2 6 6 7 8 | 2    | 0 0 5     |

Key: Class A  
9 | 0 means 9 marks

Class B  
0 | 2 means 2 marks

- (a) How many students took the test?

Answer ..... [1]

- (b) What is the highest score obtained?

Answer ..... [1]

- (c) The passing mark was 15.  
Find the percentage of students who passed the test in Class B.

Answer .....% [2]

- 7 The braking distance of a vehicle is directly proportional to the square of its speed.  
When the speed is  $v$  metres per second, the braking distance is 6 m.  
When the speed is increased by 100%, find

- (a) an expression for the new speed of the car, in terms of  $v$ ,

Answer ..... [1]

- (b) the braking distance,

Answer ..... m [2]

- (c) the percentage increase in the braking distance.

Answer .....% [2]

- 8 10 men take 16 days to complete a project.  
After 4 days, 2 men left the project.

- (a) How many **more days** will it take for the remaining 8 men to complete the project?

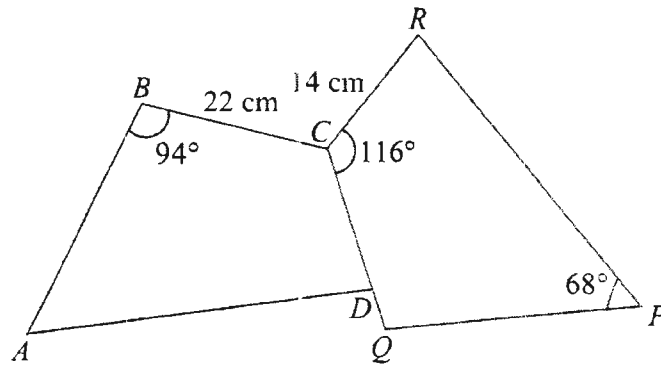
Tuition  
with  
Jason

Answer .....days [3]

- (b) What assumption is made to calculate part (a)?

Answer ..... [1]

- 9 The two quadrilaterals  $ABCD$  and  $PQCR$  are congruent.



Find

- (a) the length of  $CD$ ,

Answer ..... cm [1]

- (b) the length of  $DQ$ ,

Answer ..... cm [1]

- (c)  $\angle BAD$

Answer ..... [1]

- (d)  $\angle CRP$ .

Answer ..... [2]

- 10 (a) Solve the inequality  $3x - 7 \leq 12$ .

Answer ..... [2]

- (b) Represent the solution for (a) on the number line below.

Answer ..... [1]



- (c) Hence state the greatest value of  $x$  if

- (i)  $x$  is a prime number,

Answer  $x =$  ..... [1]

- (ii)  $x$  is a perfect square.

Answer  $x =$  ..... [1]

11 Simplify

(a)  $\frac{4a^2bc^3}{64ab^2c}$

Answer ..... [1]

(b)  $\frac{pq+1}{3p^2q+3p-2pq-2}$

Answer ..... [3]

(c)  $\frac{(c+d)(c-d)}{(c-d)^2} \div \frac{1}{(c-d)}$

Answer ..... [2]

**Tuition  
with  
Bason**

- 12 The table below shows the number of hours students in a class of 40 spend playing on the computer each day.

|                    |   |   |   |   |     |   |    |   |   |
|--------------------|---|---|---|---|-----|---|----|---|---|
| No. of hours spent | 0 | 1 | 2 | 3 | 4   | 5 | 6  | 7 | 8 |
| No. of students    | 1 | 1 | 2 | 7 | $x$ | 6 | 13 | 3 | 2 |

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

*Answer*  $x = \dots\dots\dots$  [1]

- (b) Find the mode of the distribution.

*Answer*  $\dots\dots\dots$  h [1]

- (c) Find the median of the distribution.

*Answer*  $\dots\dots\dots$  h [1]

- (d) Find the mean number of hours spent on the computer per student each day.

*Answer*  $\dots\dots\dots$  h [2]

- (e) Find the probability that one student chosen at random spent more than six hours playing on the computer each day.

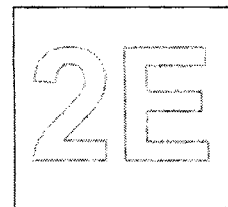
*Answer*  $\dots\dots\dots$  [1]

**End of Paper**





CANBERRA SECONDARY SCHOOL

**2022 End-of-Year Examination****Secondary Two Express****MATHEMATICS**

Paper 2

10 Oct 2023

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<br>Awarded | Max<br>Marks |
| Total            |                  | 50           |

Answer **all** the questions.

- 1 Solve the simultaneous equations.

$$\begin{aligned}y &= 8 + 2x \\ 3x - 5y &= -19\end{aligned}$$

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

---

- 2 Simplify  $\frac{3}{2x-1} - \frac{1}{2x^2+x-1}$ .

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

---

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

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

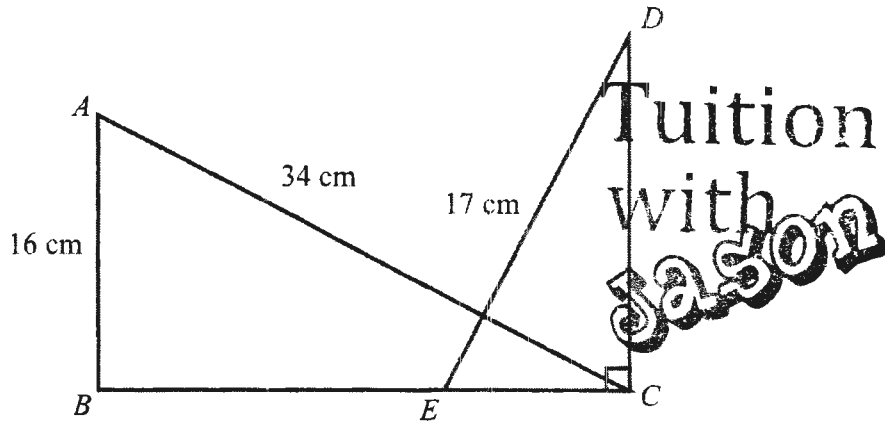
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- 4 Solve  $1 + \frac{2x-1}{5} = x-1$ .

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

---

- 5 In the figure below,  $\triangle BAC$  is similar to  $\triangle CED$ .  
 Given that  $AC = 34$  cm,  $DE = 17$  cm,  $AB = 16$  cm and  $\angle DCE = 90^\circ$ .



Find

- (a) the length of  $EC$ ,

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

- (b)  $\angle DEC$ .

Answer \_\_\_\_\_ ° [2]

- 6 Solve the equation  $(3x + 2)(3 - 2x) = 5$ .

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

---

- 7 One solution of the equation  $2x^2 + kx + 6 = 0$  is  $x = 2$ .  
Find

(a) the value of  $k$ ,

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

(b) the other solution of the equation.

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

---

8 Given that  $y = \frac{4x+1}{x-2}$ ,

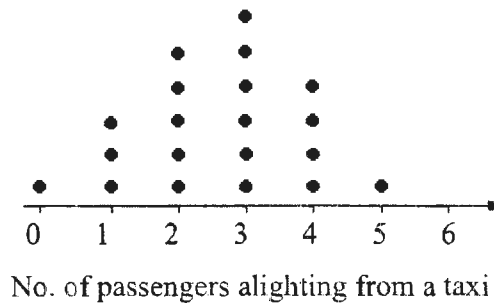
(a) Express  $x$  in terms of  $y$ .

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

(b) Find the value of  $x$  if  $y = 1$ .

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

- 9 The dot diagram shows the number of passengers alighting from each taxi that stops at a hotel porch during a certain period.



(a) How many taxis were observed during the period?

Answer ..... [1]

(b) What is the total number of passengers alighting from all the taxis?

Answer ..... [1]

(c) Calculate the mean number of passengers alighting from all the taxis.

Answer ..... [2]

10 A map of a botanical garden is drawn to a scale of 2 cm to 3 km.

- (a) The scale of the map can be expressed as 1 :  $n$ . Find  $n$ .

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

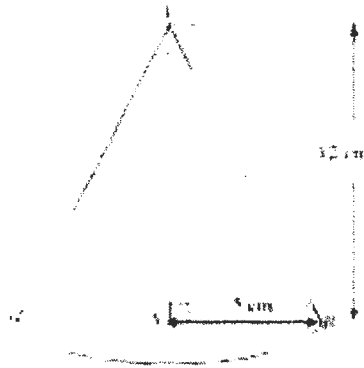
- (b) The actual perimeter of the botanical garden is 21 km.  
Find the perimeter of the botanical park on the map, in cm.

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

- (c) The botanical garden is represented by an area of 2 cm<sup>2</sup> on the map.  
Find the actual area, in km<sup>2</sup>, of the botanical park.

Answer \_\_\_\_\_ km<sup>2</sup> [2]

- 11 The figure shows a solid cone with height  $VN = 12$  cm and radius  $NB = 5$  cm.



Find

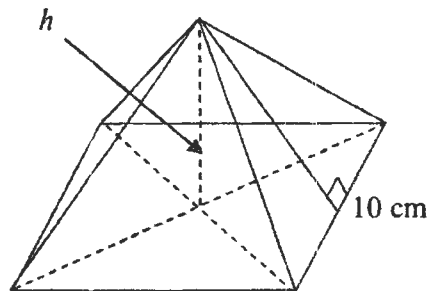
- (a) the volume of the cone,

Answer \_\_\_\_\_  $\text{cm}^3$  [1]

- (b) the total surface area of the cone.

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

A pyramid shown has a square base of sides 10 cm and has the same volume as the cone.



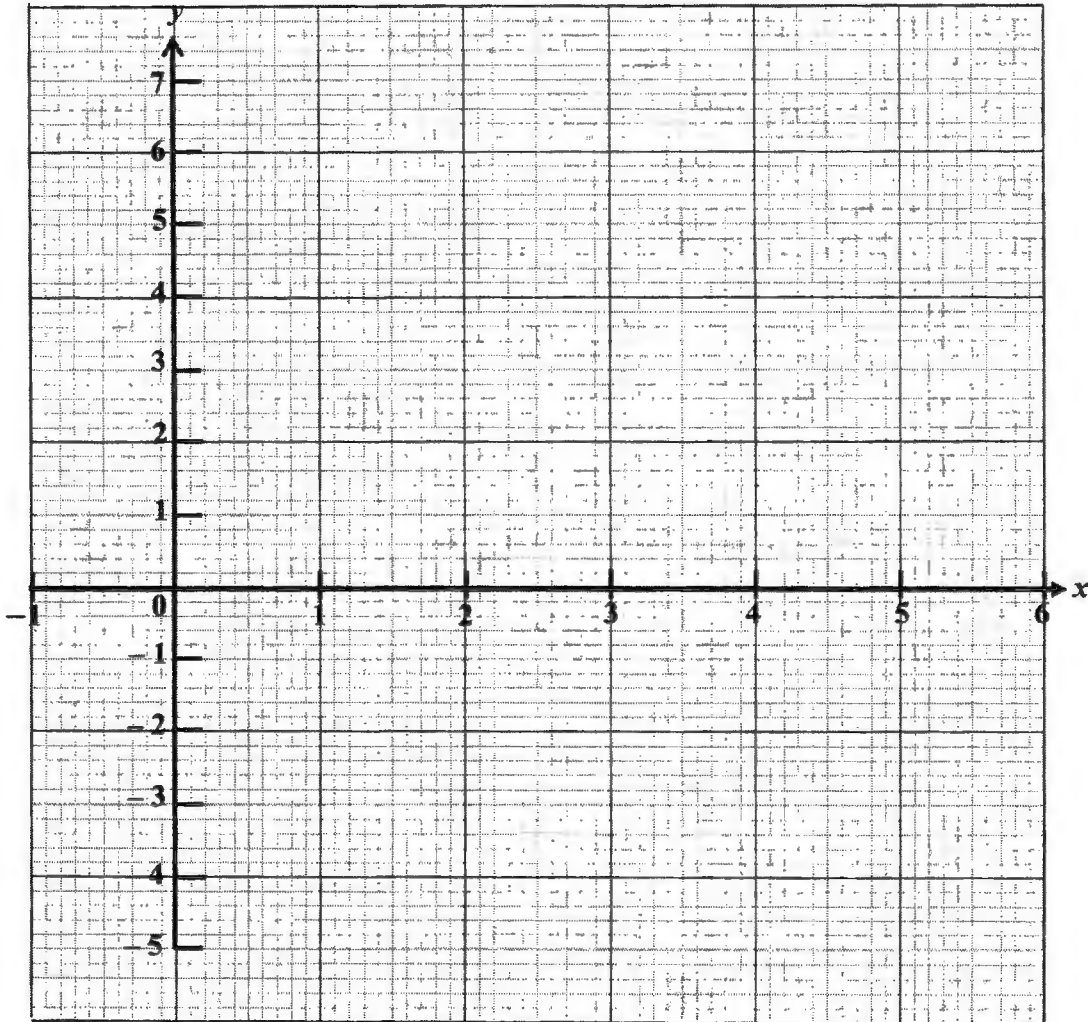
- (c) Find the height of the pyramid.  
Correct all answers to 3 significant figures.

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

- 12 (a) Complete the table of values for  $y = x^2 - 6x + 5$ . [1]

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

- (b) Draw the graph of  $y = x^2 - 6x + 5$  on the axis below. [2]



(c) Use your graph to find

(i) the values of  $x$  when  $x^2 - 6x + 5 = 1$ ,

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

(ii) the equation of line of symmetry,

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

13  $AD$  is the span of a bridge.

$BE$  and  $CF$  are the struts of the bridge.

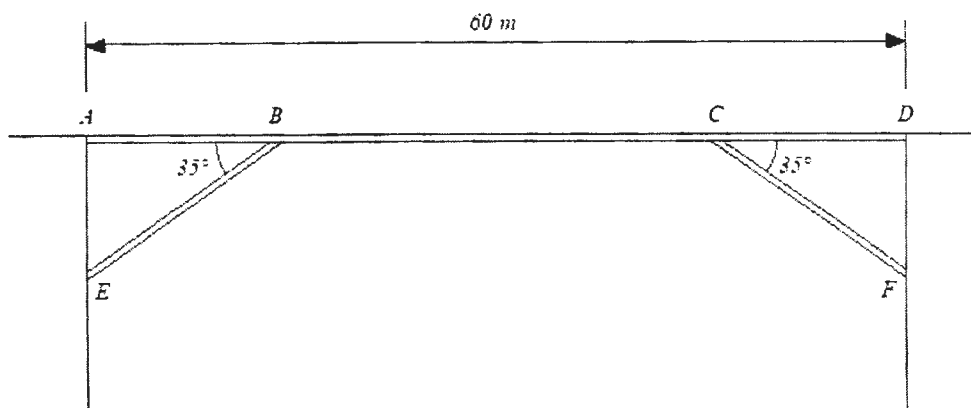
Using the information from the tables and diagram below, estimate the cost of the struts.

Explain, with calculations, how you arrive at your answer.

Leave your answer to the nearest hundred dollar.

Tuition  
with  
Jason

[6]



| DESIGN PARAMETERS |                                                         | TABLE OF TYPES OF BRIDGE STRUTS |                         |                    |
|-------------------|---------------------------------------------------------|---------------------------------|-------------------------|--------------------|
| 1                 | $AD = 60$ metres                                        | TYPE                            | LENGTH (metres)         | PRICE ( per metre) |
| 2                 | $AB = CD$                                               | A200                            | $length < 10m$          | \$1500             |
| 3                 | $AB : BC = 1 : 2$                                       | A210                            | $10m \leq length < 20m$ | \$2300             |
| 4                 | The angle between the span and the struts is $35^\circ$ | A320                            | $20m \leq length < 30m$ | \$3800             |
|                   |                                                         | A350                            | $30m \leq length < 40m$ | \$4300             |
|                   |                                                         | A380                            | $40m \leq length < 50m$ | \$5020             |

Answer



**2023 Final Year Examination**  
**Sec 2E Mathematics Paper 1 Marking Scheme**

- 1**       $4a(b+c) - 3b(a-7c)$
- $= 4ab + 4ac - 3ab + 21bc$  [M1]
- $= ab + 4ac + 21bc$  [A1]
- 2**       $12a^2 - 75$
- $= 3(4a^2 - 25)$  [M1]
- $= 3(2a+5)(2a-5)$  [A1]
- 3(a)**    $AC^2 = 13^2 = 169$
- $AB^2 + BC^2 = 5^2 + 12^2 = 169$  [M1]
- Since  $AC^2 = AB^2 + BC^2$ ,
- By the converse of Pythagoras' Theorem,
- Triangle ABC is a right-angled triangle [A1]
- (b)**       $\tan(\angle ACB) = \frac{5}{12}$  [M1] o.e
- $\angle ACB = \tan^{-1}\left(\frac{5}{12}\right) = 22.6^\circ$  [A1]
- 4(a)**       $\frac{3}{7}$  [B1]
- (b)**       $\frac{9}{14}$  [B1]
- (c)**       $\frac{3}{17}$  [B1]

Tuition  
with  
Jason

5(a) Total work days =  $10 \times 16 = 160 \text{ days}$  [M1]

4 days  $\rightarrow$  40 work days completed

Remaining  $\rightarrow 160 - 40 = 120$  work days

Remaining Days =  $\frac{120}{8} = 15 \text{ days}$  [M1]

Additional days =  $4 + 15 - 16 = 3$  days [A1]

(b) It is assumed that all men work at the same rate. [B1]

6(a) 21 [A1]

(b) 28 [A1]

(c)  $\frac{7}{11} \times 100\%$  [M1]

= 63.6% [A1]

7(a)  $2v$  [A1]

(b)  $d = kv^2$

$d_1 = k(2v)^2$  [M1]

=  $4kv^2$

=  $4d$

=  $4(6) = 24 \text{ m}$  [A1]

(c)  $\frac{24-6}{6} \times 100\%$  [M1]

= 300% [A1]

8(a)  $3 + 7 + 11 + 8 + 6 + 5 = 40$

[A1]

(b)  $\frac{3}{40} \times 100\% = 7.5\%$

[A1]

(c)  $\frac{32}{40} = \frac{4}{5}$

[A1]

(d)  $7 + 22 + 24 + 24 + 25 = 105 \text{ h}$

[A1]

9(a) 14 cm

[A1]

(b)  $22 - 14 = 8 \text{ cm}$

[A1]

(c)  $68^\circ$

[A1]

(d)  $360 - 116 - 94 - 68$

[M1]

$= 82^\circ$

[A1]

10(a)  $3x - 7 \leq 12$

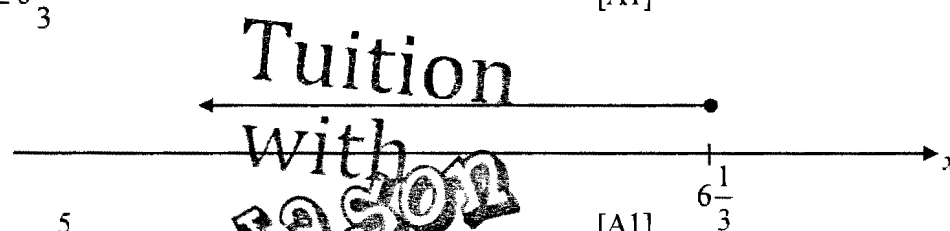
$3x \leq 19$

[M1]

$x \leq 6\frac{1}{3}$

[A1]

(b)



[A1]

(c)(i) 5

[A1]

(c)(ii) 4

[A1]

$$11(a) \quad \frac{4a^2bc^3}{64ab^2c} = \frac{ac^2}{16b} \quad [A1]$$

$$(b) \quad \frac{pq+1}{3p(pq+1)-2(pq+1)} \quad [M1]$$

$$= \frac{pq+1}{(pq+1)(3p-2)} \quad [M1]$$

$$= \frac{1}{3p-2} \quad [A1]$$

$$(c) \quad \frac{(c+d)(c-d)}{(c-d)^2} \times \frac{c-d}{1} \quad [M1]$$

$$= c+d \quad [A1]$$

Tuition  
with  
Jason

$$12(a) \quad x = 5 \quad [A1]$$

$$(b) \quad 6 \text{ h} \quad [A1]$$

$$(c) \quad \text{middle} = 20.5^{\text{th}} \text{ student}$$

$$\text{Median} = 5\text{h} \quad [A1]$$

$$(d) \quad \text{Mean} = \frac{1+4+21+20+30+78+21+16}{40} \quad [M1]$$

$$= 4.775 \text{ h} \quad [A1]$$

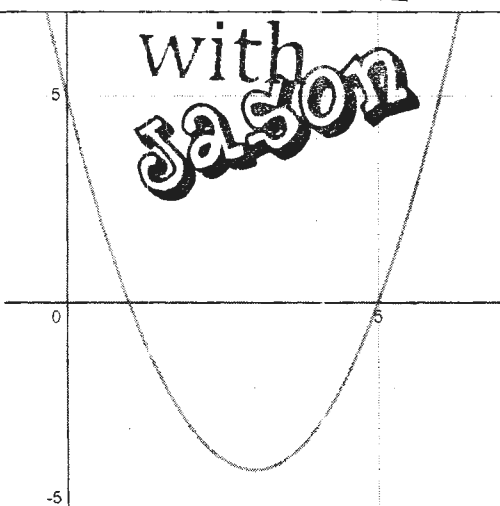
$$(e) \quad \frac{5}{40} = \frac{1}{8} \quad [A1]$$

**MARKING SCHEME**  
**2E MATHS PAPER 2 2023**

| Qn | Solution                                                                                                                       | Marks                            | Remarks                                                                                                                       |
|----|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------|
| 1  | $3x - 5(8 + 2x) = -19$ o.e<br>$x = -3$ , $y = 2$                                                                               | M1<br>A1, A1                     |                                                                                                                               |
| 2  | $\frac{3}{2x-1} - \frac{1}{(2x-1)(x+1)}$ $\frac{3(x+1)}{(2x-1)(x+1)} - \frac{1}{(2x-1)(x+1)}$ $\frac{3x+2}{(2x-1)(x+1)}$ o.e   | M1<br>M1<br>A1                   | Factorisation of denominator seen<br>Attempt to make the denominator same                                                     |
| 3  | $\frac{2m+1}{(m-2)} + \frac{m+2}{3(m-2)}$ $\frac{3(2m+1)}{(m-2)} + \frac{m+2}{3(m-2)}$ $\frac{7m+5}{3(m-2)}$ o.e               | M1<br>M1<br>A1                   | Correct attempt to make denominator same by multiplying second fraction by -1<br>Correct attempt to make the denominator same |
| 4  | $\frac{2x-1}{5} = x-2$ $2x-1 = 5x-10$ $x = 3$ Alternate solution<br>$\frac{5}{5} + \frac{2x-1}{5} = x-1$ $2x+4 = 5x-5$ $x = 3$ | M1<br>M1<br>A1<br>M1<br>M1<br>A1 | Attempt to group the constants together<br>Attempt to make the denominator same                                               |

|      |                                                                                        |                |                                                    |
|------|----------------------------------------------------------------------------------------|----------------|----------------------------------------------------|
| 5(a) | 8 cm                                                                                   | B1             |                                                    |
| 5(b) | $\cos \angle DEC = \frac{8}{17}$<br>$\angle DEC = \cos^{-1} \frac{8}{17} = 61.9^\circ$ | M1<br>A1       | Use of own value from (a) instead of 8 acceptable  |
| 6    | $9x+6-6x^2-4x=5$ o.e<br>$(6x+1)(x-1)=0$<br>$x=-\frac{1}{6}$ or $x=1$                   | M1<br>A1       |                                                    |
| 7(a) | $2(2)^2+k(2)+6=0$<br>$k=-7$                                                            | M1<br>A1       | Substitution seen                                  |
| 7(b) | $(2x-3)(x-2)=0$<br>$x=2$ (rejected) or $x=\frac{3}{2}$                                 | M1<br>A1       | Factorisation seen<br>Must reject one solution     |
| 8(a) | $y(x-2)=4x+1$<br>$x(y-4)=2y+1$<br>$x=\frac{2y+1}{y-4}$ o.e                             | M1<br>M1<br>A1 | Attempt to remove denominator<br>Factorise the 'x' |
| 8(b) | -1                                                                                     | B1             |                                                    |
| 9(a) | 20                                                                                     | B1             |                                                    |

|       |                                                                                                                                  |          |                                                          |
|-------|----------------------------------------------------------------------------------------------------------------------------------|----------|----------------------------------------------------------|
| 9(b)  | 52                                                                                                                               | B1       |                                                          |
| 9(c)  | mean = $\frac{52}{20}$<br>= 2.6                                                                                                  | M1<br>A1 | Use of own value in 9(b) instead of 52<br>acceptable     |
| 10(a) | 2cm → 300000cm<br>1:150000                                                                                                       | B1       |                                                          |
| 10(b) | 14 cm                                                                                                                            | B1       |                                                          |
| 10(c) | 4cm <sup>2</sup> → 9km <sup>2</sup><br>2cm <sup>2</sup> → 4.5km <sup>2</sup>                                                     | M1<br>A1 |                                                          |
| 11(a) | 314 cm <sup>2</sup>                                                                                                              | B1       | Or more accurate answer                                  |
| 11(b) | Slant height = $\sqrt{12^2 + 5^2} = 13$ cm<br>Total surface area of cone =<br>$\pi(5)(13) + \pi(5^2) = 282.743 = 283\text{cm}^2$ | M1<br>A1 | Slant height found<br><br>Or more accurate answer        |
| 11(c) | $\frac{1}{3}(100)(h) = 314.159$<br>$h = 9.42477 = 9.42\text{cm}$                                                                 | M1<br>A1 | Correct manipulation seen<br><br>Or more accurate answer |

|         |                                                                                    |                          |                                                                                                                                                                      |  |
|---------|------------------------------------------------------------------------------------|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 12(a)   | -4                                                                                 | Tuition<br>with<br>Jason | B1                                                                                                                                                                   |  |
| 12(b)   |  | B1<br><br>B1             | Correct points<br><br>Smooth curve                                                                                                                                   |  |
| 12(ci)  | $x = 0.7$ or $x = 5.2 \pm 0.1$                                                     | B1, B1                   | Answer with 5 in the second decimal place for example 0.75 or 5.25 accepted. If not, student could be suspected of using calculator to arrive at the answer instead. |  |
| 12(cii) | $x = 3$                                                                            | B1                       |                                                                                                                                                                      |  |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                             |                                                                                                                                                                                                                                    |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 13 | <p>To find the length of <math>AB</math>, <math>BC</math> and <math>CD</math></p> <p><math>AB : BC : CD</math><br/>1 : 2 : 1</p> <p><math>4U \rightarrow 60m</math><br/><math>1U \rightarrow 15m</math><br/><math>2U \rightarrow 30m</math></p> <p><math>AB : BC : CD</math><br/>15 : 30 : 15</p> <p>To find the length of <math>BE</math> and <math>CF</math>,</p> <p><math>\cos 35^\circ = \frac{15}{BE}</math></p> <p><math>BE = \frac{15}{\cos 35^\circ} = 18.3116m</math></p> <p>Total length of struts = <math>2(18.3116) = 36.623 \text{ m}</math><br/>Cost of the struts = <math>36.623 \times 2300</math><br/>= \$ 84 232.90<br/>= \$ 84 200</p> | <p>M1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>M1</p> <p>A1</p> | <p>2 marks given if the student able to derive that <math>AB</math> and <math>CD</math> is 15 m</p> <p>Correct selection of strut size seen. Not acceptable if <math>BE</math> is inaccurate. Answer correct to nearest \$100.</p> |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

