**NAME :** _____( )  **MARKS :**_____/40

**CLASS : 2E___ / 2A___ SBB**

# MATHEMATICS
## PAPER 1

**Wednesday** **28 September 2022** **1 hour**



**JUYING SECONDARY SCHOOL**
**END OF YEAR EXAMINATION**
**SECONDARY TWO EXPRESS/TWO NORMAL ACADEMIC (SBB)**

**READ THESE INSTRUCTIONS FIRST**

Write your name, register number, class and date in the space provided.
Write in dark blue or black pen.
You may use an HB 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 of the marks for this paper is 40.

Setter: Ms Rachel Tham
Vetter: Mrs Wong-Chia Pei San

This Question Paper consists of 10 printed pages including this page.

**Answer all questions.**

**1.** It is given that $p = \frac{u^2 - v^2}{q}$.

**(a)** Find $p$ when $q = 3, u = -5$ and $v = 7$.

*Answer* $p =$ ..... [1]

**(b)** Express $v$ in terms of $p, q$ and $u$.

*Answer* $v =$ ..... [2]

---

**2.** **(a)** Solve the inequality $1 - 4x \geq 19$.

*Answer* ..... [2]

**(b)** Hence, write down the greatest integer value of $x$ which satisfies $1 - 4x \geq 19$.

*Answer* ..... [1]

---

**3.** **(a)** Factorise $4x^2 - 9$.

*Answer* ..... [1]

**(b)** **Hence,** express $\frac{1}{2x+3} - \frac{x}{(4x^2-9)}$ as a single fraction in its simplest form.



*Answer* ..... [2]

---

**4.** Expand and simplify the following expressions.

**(a)** $-ab(7a - b)$



*Answer* ..... [1]

**(b)** $(2p + 3q)(p - q)$

*Answer* ..... [1]

---

**5.** The scale of a map is such that 5 cm represents 3 km.

**(a)** Write this scale in the form 1: $n$.

*Answer* 1 : ..... [1]

**(b)** The distance on the map between a hawker centre and a nature park is 2.5 cm.
Calculate the actual distance, in kilometres.

*Answer* ..... km [1]

**(c)** The nature park covers an area of 1.17 $km^2$.
Find the area, in square centimetres, covered by the nature park on the map.

*Answer* ..... $cm^2$ [2]

**6.** Factorise the following expressions completely.

**(a)** $21p^2 + 15p$

*Answer* ..... [1]

**(b)** $4ax - 21by + 6ay - 14bx$

*Answer* ..... [2]

---

**7.** Ariel spins a fair five-sided spinner with numbers 2, 3, 4, 5 and 6.
Write down the probability that the spinner lands on

**(a)** an even number,

*Answer* ..... [1]

**(b)** a prime number,

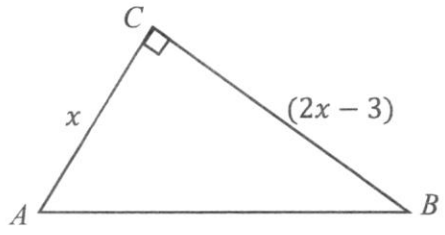
*Answer* ..... [1]

**(c)** the number 8.

*Answer* ..... [1]

---

**8.** In $\Delta ABC$, $AC$ is perpendicular to $BC$.
$AC = x$ cm and $BC = (2x - 3)$ cm.




**(a)** Given the area of triangle is 17.5 cm$^2$, form an equation in $x$ and show that it reduces to

$$2x^2 - 3x - 35 = 0.$$

[2]

*Answer*



**(b)** Hence, solve the equation $2x^2 - 3x - 35 = 0$.



*Answer* $x =$ ..... or ..... [3]

**(c)** Explain why one of the values of $x$ is rejected.

*Answer*



$x =$ ..... is rejected because .....

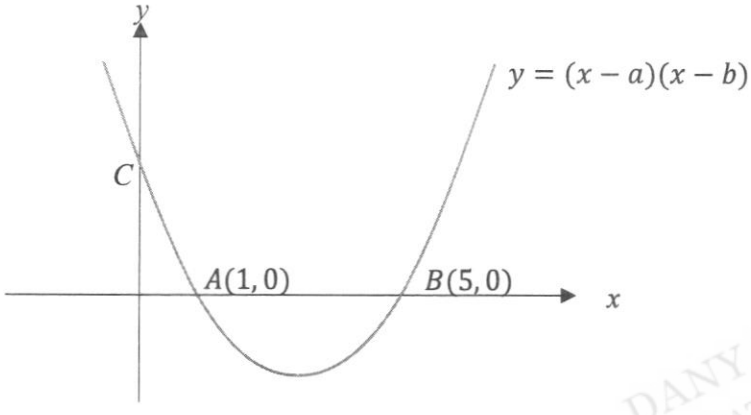
.....

..... [1]

**(d)** State the value of tan $\angle ABC$, giving your answer in fraction in its simplest form.

*Answer* ..... [1]

**9.** The diagram shows the curve $y = (x - a)(x - b)$.
The curve cuts the $x$-axis at two points $A(1, 0)$ and $B(5, 0)$, and the $y$-axis at point $C$.






**(a)** Find the value of $a$ and of $b$.

*Answer* $a =$ ..... [1]

$b =$ ..... [1]

**(b)** Find the coordinates of $C$.

*Answer* $C =$ (..... , .....) [1]

**(c)** Hence, find the coordinates of the minimum point.

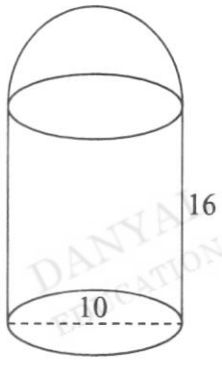
*Answer* ( ..... , .....) [2]

**10.** Five numbers are written on the board.
The mean of these numbers is 14.8.
The mode and median are 16.
The difference between the highest and lowest number is 9 and the highest number is twice the value of the lowest number.
Find the five numbers.



*Answer* ....., ....., ....., ....., ..... [4]

**11.** A solid consists of a hemisphere and a cylinder which share a common base.
The cylinder has a base diameter of 10 cm and a height of 16 cm.
Find the volume of the solid.






*Answer* ..... $cm^3$ [3]

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**End of Paper**

**NAME :** _____( )  **MARKS :**_____/60

**CLASS : 2E___ / 2A___ SBB**

# MATHEMATICS
## PAPER 2

**Friday** **30 September 2022** **1 hour 30 minutes**



**JUYING SECONDARY SCHOOL**
**END OF YEAR EXAMINATION**
**SECONDARY TWO EXPRESS/TWO NORMAL ACADEMIC (SBB)**

**READ THESE INSTRUCTIONS FIRST**

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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 of the marks for this paper is 60.

Setter: Ms Rachel Tham
Vetter: Mrs Wong-Chia Pei San

This Question Paper consists of 15 printed pages including this page.

**Answer all questions.**

**1.** Solve the simultaneous equations

$$2x - y = 16$$
$$2x + 3y = 25$$

*Answer* $x =$.....

$y =$..... [3]

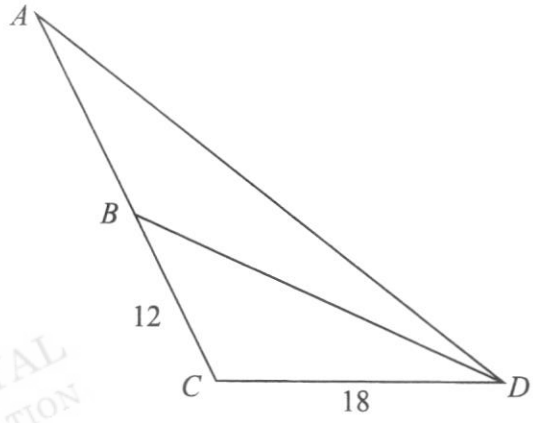
---

**2.** $n$ is a positive integer.
Show that $(2n + 1)^2 - (2n - 3)^2$ is a multiple of 8 for all integer values of $n$.

*Answer* [3]

---

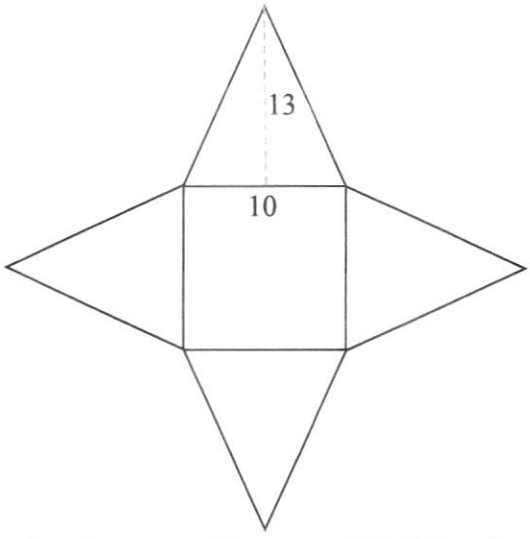
**3.** Triangle $ACD$ is similar to triangle $DCB$.
$BC = 12$ cm and $CD = 18$ cm.
Find the length of $AB$.






*Answer* ..... cm [3]

**4.** The diagram shows the net of a pyramid. It consists of a square and 4 triangles. The length of each side of the square is 10 cm. The height of the triangle is 13 cm.






**(a)** Show that the total surface area of the pyramid is 360 $cm^2$.

*Answer* [2]



**(b)** Find the volume of the pyramid.



*Answer* ..... $cm^3$ [3]

**5.** Express as a single fraction in its simplest form.

**(a)** $\dfrac{9x^2}{5y^3} \div \dfrac{6x^3}{y^4}$

*Answer* ..... [2]

**(b)** $\dfrac{5x}{4} - \dfrac{2(5-3x)}{3}$



*Answer* ..... [3]

---

**6.** Solve the equation $\frac{5}{(x-2)} - \frac{x^2-3}{(x+1)(2-x)} = 1$



*Answer* $x =$ ..... [4]

---

7. $y$ is directly proportional to the cube of $x$.
Given that $y = 4$ when $x = 2$, find

**(a)** an equation connecting $y$ and $x$.

*Answer* ..... [2]

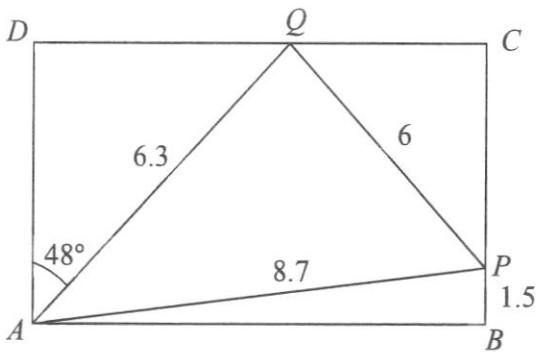
**(b)** Find the value of $x$ when $y = 10$.

*Answer* ..... [1]

**(c)** When $x$ is doubled, $y$ is eight times its original value.
Prove that the above statement is correct.

*Answer* [2]

**8.** A rectangular signboard, $ABCD$, is supported by three cables, $AP$, $AQ$ and $PQ$.
Given that $AP = 8.7$ m, $AQ = 6.3$ m, $PQ = 6$ m, $BP = 1.5$ m and $\angle DAQ = 48°$.




Calculate
**(a)** $AD$,

*Answer* ..... m [2]

**(b)** $\angle BAP$.

*Answer* ..... ° [2]

**(c)** Show that triangle $APQ$ is a right-angled triangle.

*Answer* [2]



---

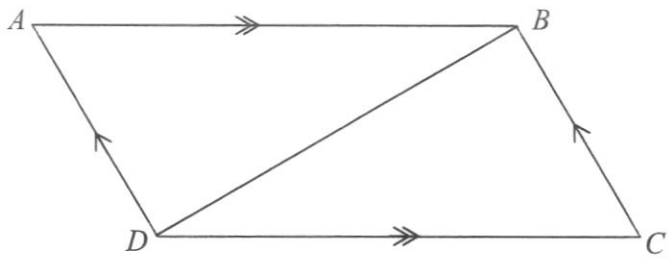
**9.** Tap $A$ takes 5 minutes to fill up a water tank.
Tap $B$ takes 7 minutes to fill up the same water tank.
Find the time, in minutes and seconds, required for both taps to fill the water tank.
Assume that both taps are turned on at the same time and the rate of water flow for each tap is constant.



*Answer* ..... min ..... s [3]

---

**10.** In the figure below, $ABCD$ is a parallelogram with $AB \,//\, DC$ and $AD \,//\, BC$.




Complete the following statements for proof of congruency.

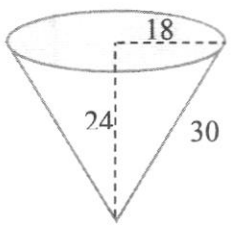
*Answer*

**(a)** $AB =$ ..... (opposite sides of parallelogram are equal) [1]
$AD = CB$ (opposite sides of parallelogram are equal)
$BD$ is common.

**(b)** $\angle ABD = \angle CDB$ (.....) [1]
$\angle BAD = \angle DCB$ (opposite angles of parallelogram)

**(c)** $\therefore\ \Delta ADB$ is congruent to $\Delta$ ..... [1]

**11.** Cally is a home-based chocolatier.
The diagram shows the dimensions, in millimetres, of the conical mould that she uses to make her chocolates.




**(a)** The mould is filled to the brim with chocolate.
Show that the total surface area of the solidified chocolate is 2710 $mm^2$, corrected to 3 significant figures.
*Answer* [3]

**(b)** Calculate the volume of the chocolate, leaving your answer in terms of $\pi$.

*Answer* ..... $mm^3$ [2]

**(c)** With the same quantity of ingredients, she could also make the chocolate using a spherical mould.
Calculate the radius of the spherical mould.



*Answer* ..... mm [2]

**(d)** Each chocolate is wrapped tightly with a foil wrapper.
The cost of wrapper is proportional to its area used.
Assuming wastage of wrapper is negligible, justify if Cally should make her chocolates in the form of a cone or a sphere.



*Answer* Cally should make her chocolate in the form of .....

because ..... [2]

**12** A group of students took a test.
Their results are shown in the stem-and-leaf diagram below.

| Stem | Leaf | | | | |
|---|---|---|---|---|---|
| 0 | 8 | | | | |
| 1 | 1 | 1 | 2 | 3 | 9 |
| 2 | 4 | 4 | $x$ | 5 | 7 |

Key: 1|2 means 12

**(a)** **(i)** If the modal score is 24, find the value of $x$.

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

**(ii)** Hence, calculate the mean score.

*Answer* ..... [2]

**(b)** A student must score at least 25 marks to get a distinction.
Find the fraction of students who scored a distinction.

*Answer* ..... [1]

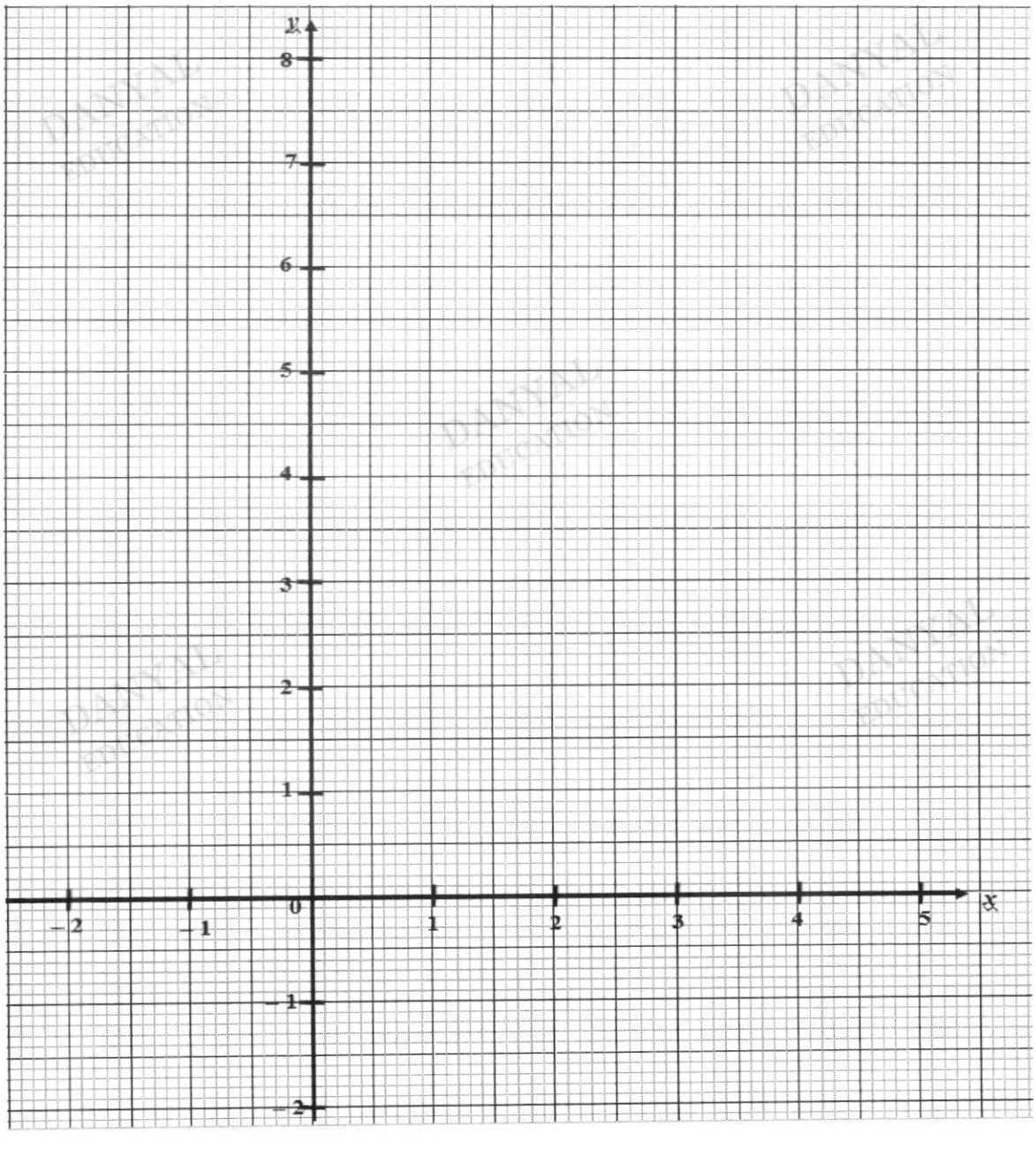
**13.** The table below shows the corresponding values of $x$ and $y$, where $y = -x^2 + 3x + 5$.

| $x$ | −1.5 | −1 | 0 | 1 | 2 | 3 | 4 | 4.5 |
|---|---|---|---|---|---|---|---|---|
| $y$ | −1.75 | $a$ | 5 | 7 | 7 | 5 | 1 | −1.75 |

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

*Answer* $a =$ ..... [1]

**(b)** On the grid, plot the graph of $y = -x^2 + 3x + 5$ for $-1.5 \leq x \leq 4.5$. [2]



**(c)** Using your graph in part **(b)**,

**(i)** find the coordinates of the turning point,

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

**(ii)** Draw $y = 3$ and hence, find the values of $x$ when $-x^2 + 3x + 5 = 3$

*Answer* $x$ =..... or ..... [3]

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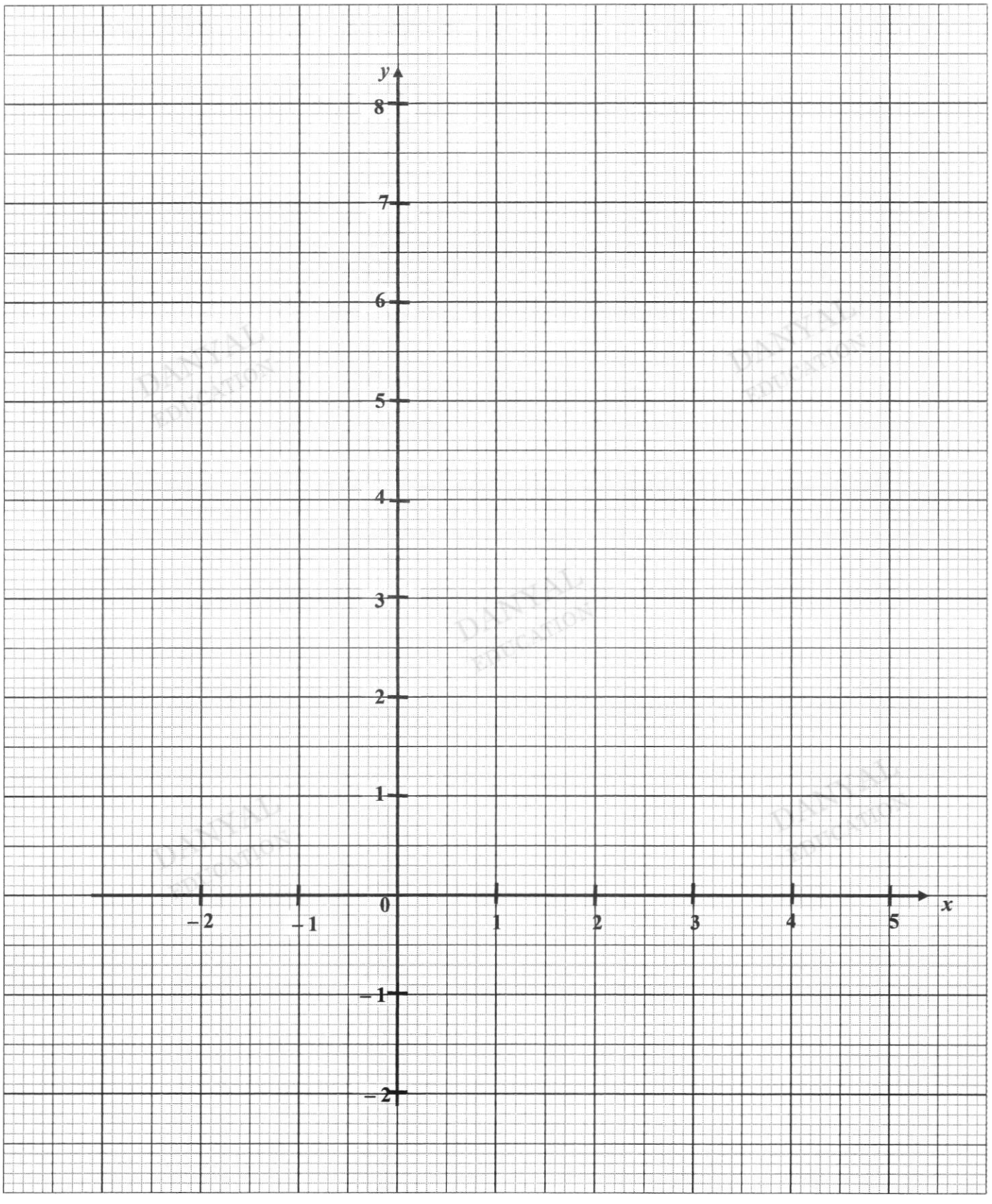
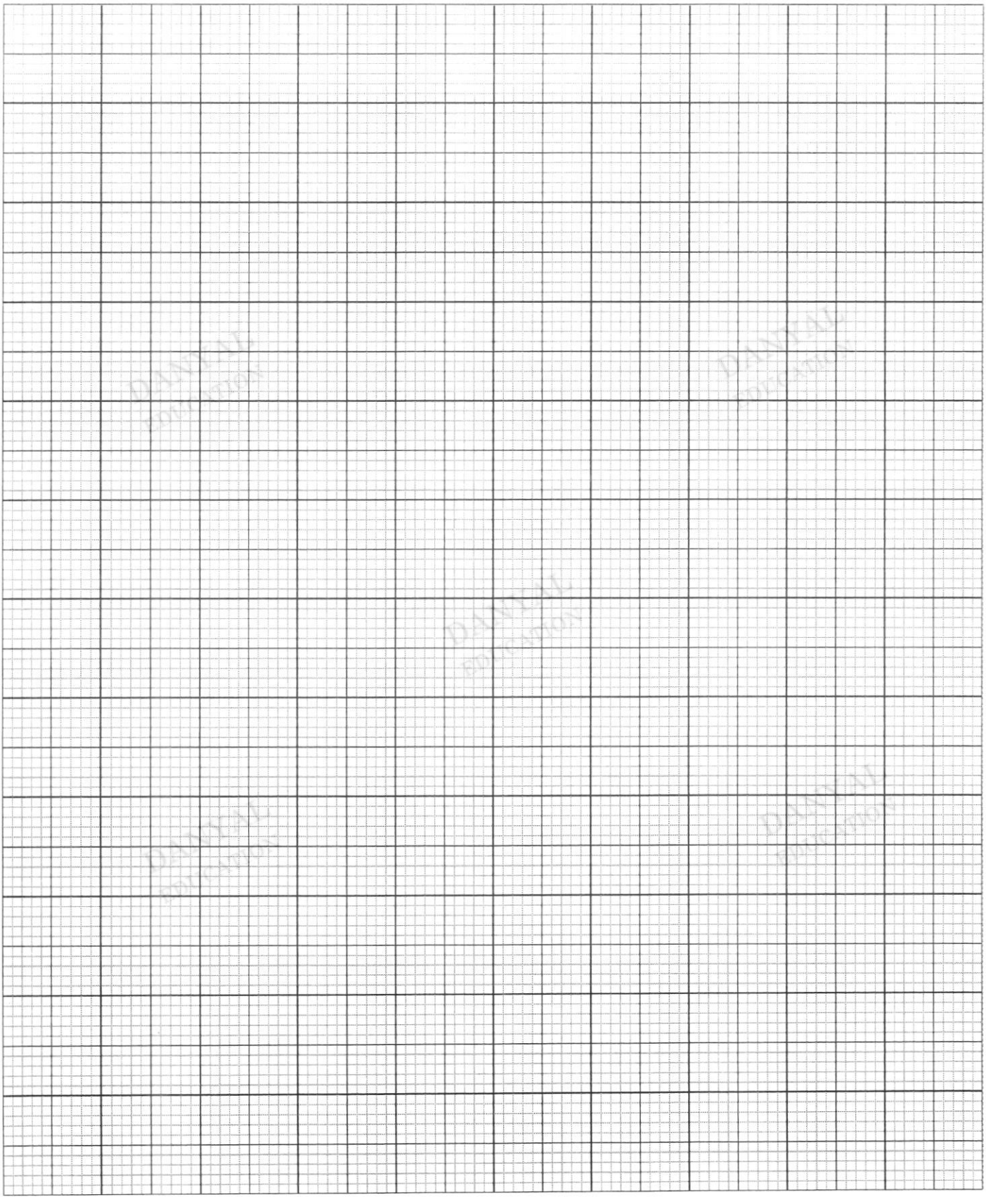
**End of Paper**


y
8
7
6
5
4
3
2
1
0
−1
−2
x
−2
−1
1
2
3
4
5



NAME : _____( )  MARKS :_____/40

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**MARKING SCHEME**

# MATHEMATICS
## PAPER 1

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**Answer all questions.**

1. It is given that $p = \frac{u^2 - v^2}{q}$.

**(a)** Find $p$ when $q = 3, u = -5$ and $v = 7$.

$$p = \frac{(-5)^2 - (7)^2}{3}$$
$$p = -8 \quad \text{--[B1]}$$

*Answer* $p =$ ..... [1]

**(b)** Express $v$ in terms of $p, q$ and $u$.

$$p = \frac{u^2 - v^2}{q}$$
$$pq = u^2 - v^2 \quad [M1]$$
$$v^2 = u^2 - pq$$
$$v = \pm\sqrt{u^2 - pq} \quad [A1]$$

*Answer* $v =$ ..... [2]

---

2. **(a)** Solve the inequality $1 - 4x \geq 19$.

$$1 - 4x \geq 19$$
$$-4x \geq 19 - 1$$
$$4x \leq -18 \quad [M1]$$
$$x \leq -4.5 \quad [A1]$$

*Answer* ..... [2]

**(b)** Hence, write down the greatest integer value of $x$ which satisfies $1 - 4x \geq 19$.

$-5$ [B1]

*Answer* ..... [1]

---

3. **(a)** Factorise $4x^2 - 9$.

$(2x + 3)(2x - 3)$ [B1]

*Answer* ..... [1]

**(b) Hence,** express $\frac{1}{2x+3} - \frac{x}{(4x^2-9)}$ as a single fraction in its simplest form.

$= \frac{1}{(2x+3)} - \frac{x}{(2x+3)(2x-3)}$

$= \frac{1(2x-3)-x}{(2x+3)(2x-3)}$ [M1: common denominator/ ECF1]

$= \frac{x-3}{(2x+3)(2x-3)}$ [A1]

*Answer* ..... [2]

---

4. Expand and simplify the following expressions.

**(a)** $-ab(7a - b)$

$-7a^2b + ab^2$ [B1]

*Answer* ..... [1]

**(b)** $(2p + 3q)(p - q)$

$2p^2 + pq - 3q^2$ [B1]

*Answer* ..... [1]

---

**5.** The scale of a map is such that 5 cm represents 3 km.

**(a)** Write this scale in the form 1 : $n$.

| | | |
|---|---|---|
| 5cm | rep. | 3 km |
| 1 cm | rep. | 0.6 km |
| | | = 60 000 cm |
| 1 : 60 000 | | [B1] |

*Answer* 1 : ..... [1]

**(b)** The distance on the map between a hawker centre and a nature park is 2.5 cm.
Calculate the actual distance, in kilometres.

| | | |
|---|---|---|
| 1 cm | rep. | 0.6 km |
| 2.5 cm | rep. | ? km |
| Actual distance = 0.6 x 2.5 | | |
| = 1.5 km | | [B1] |

*Answer* ..... km [1]

**(c)** The nature park covers an area of 1.17 $km^2$.
Find the area, in square centimetres, covered by the nature park on the map.

| | | |
|---|---|---|
| 1 cm | rep. | 0.6 km |
| 1$cm^2$ | rep. | $(0.6)^2$ $km^2$ [M1] |
| | | =0.36 $km^2$ |
| ? $cm^2$ | rep. | 1.17 $km^2$ |
| Area on map = $\frac{1.17}{0.36}$ | | |
| = 3.25 $cm^2$ | | [A1] |

*Answer* ..... $cm^2$ [2]

**6.** Factorise the following expressions completely.

**(a)** $21p^2 + 15p$

$3p(7p + 5)$ [B1]

*Answer* ..... [1]

**(b)** $4ax - 21by + 6ay - 14bx$

$= 4ax - 21by + 6ay - 14bx$
$= 4ax + 6ay - 14bx - 21by$
$= 2a(2x + 3y) - 7b(2x + 3y)$ [M1]
$= (2a - 7b)(2x + 3y)$ [A1]

*Answer* ..... [2]

---

**7.** Ariel spins a fair five-sided spinner with numbers 2, 3, 4, 5 and 6.
Write down the probability that the spinner lands on

**(a)** an even number,

$\frac{3}{5}$ [B1]

*Answer* ..... [1]

**(b)** a prime number,

$\frac{3}{5}$ [B1]

*Answer* ..... [1]

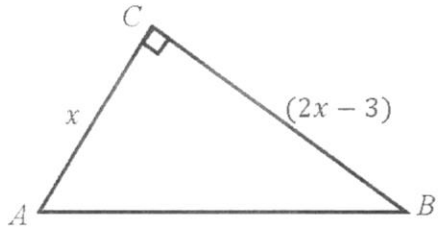
**(c)** the number 8.

0 [B1]

*Answer* ..... [1]

---

**8.** In $\Delta ABC$, $AC$ is perpendicular to $BC$.
$AC = x$ cm and $BC = (2x - 3)$ cm.




**(a)** Given the area of triangle is 17.5 cm$^2$, form an equation in $x$ and show that it reduces to

$$2x^2 - 3x - 35 = 0.$$

[2]

*Answer*

$\frac{1}{2}(x)(2x - 3) = 17.5$ [M1]

$2x^2 - 3x = 35$

$2x^2 - 3x - 35 = 0$ (shown) [A1]

**(b)** Hence, solve the equation $2x^2 - 3x - 35 = 0$.

$(x - 5)(2x + 7) = 0$ [M1]

$x = 5$ *or* $x = -3.5$ [A1, A1]

*Answer* $x =$ ..... or ..... [3]

**(c)** Explain why one of the values of $x$ is rejected.

*Answer*

..... $x = -3.5$ is rejected because the length of the side of a triangle cannot ..... be of a negative value. [B1]

..... [1]

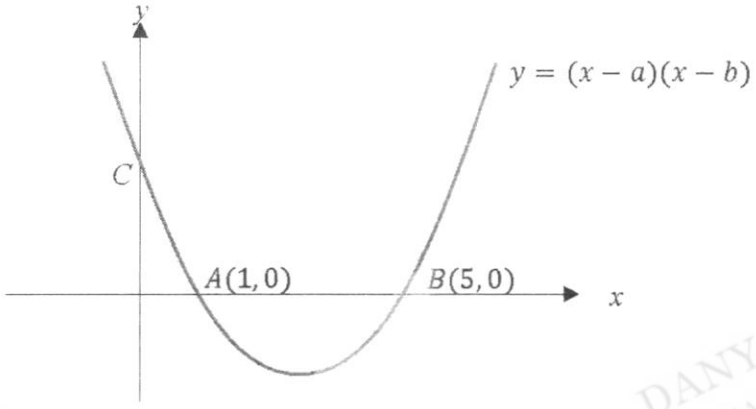
**(d)** State the value of tan $\angle ABC$, giving your answer in fraction in its simplest form.

$\tan \angle ABC = \frac{x}{2x-3}$

$\tan \angle ABC = \frac{5}{7}$ [B1]

*Answer* ..... [1]

**9.** The diagram shows the curve $y = (x - a)(x - b)$.
The curve cuts the $x$-axis at two points $A(1, 0)$ and $B(5, 0)$, and the $y$-axis at point $C$.




**(a)** Find the value of $a$ and of $b$.

| | |
|---|---|
| $a = 1$ | [B1] or $a = 5$ |
| $b = 5$ | [B1] or $b = 1$ |

*Answer* $a =$ ..... [1]

$b =$ ..... [1]

**(b)** Find the coordinates of $C$.

| | |
|---|---|
| When $x = 0$ | |
| $y = (0 - 1)(0 - 5) = 5$ | |
| $C = (0,5)$ | [B1] |

*Answer* $C =$ (....., .....) [1]

**(c)** Hence, find the coordinates of the minimum point.

| | |
|---|---|
| $x = \frac{5+1}{2} = 3$ | [M1:attempt to find $x$ value] |
| $y = (3 - 1)(3 - 5) = -4$ | |
| $\min point = (3, -4)$ | [A1] |

*Answer* ( ....., .....) [2]

**10.** Five numbers are written on the board.
The mean of these numbers is 14.8.
The mode and median are 16.
The difference between the highest and lowest number is 9 and the highest number is twice the value of the lowest number.
Find the five numbers.

*Answer*

Total marks = $14.8 \times 5$ [M1]
$= 74$

1st and 5th position:
Let the lowest value be $x$ and highest value be $2x$.
Since $2x - x = 9$
therefore $x = 9$ and $2x = 18$ [M1 or B1]

3rd position: Median = 16 [B1]

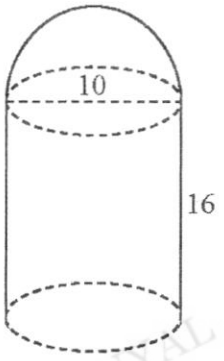
$74 - 9 - 16 - 18 = 31$

Since mode = 16, $31 - 16 = 15$ [B1]

$\therefore$ 9, 15, 16, 16, 18

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

**11.** A solid consists of a hemisphere and a cylinder which share a common base.
The cylinder has a base diameter of 10 cm and a height of 16 cm.
Find the volume of the solid.




$radius = \frac{10}{2} = 5$

Volume
$= (\frac{1}{2} \times \frac{4}{3} \times \pi \times 5^3) + (\pi \times 5^2 \times 16)$ [M1, M1]
$= 1518.436$
$= 1520$ cm$^3$ (3 s.f.) [A1]

*Answer* ..... cm$^3$ [3]

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**End of Paper**

NAME : _____( )  MARKS :_____/60

CLASS : 2E___ / 2A___ SBB

**MARKING SCHEME**

# MATHEMATICS
## PAPER 2

**Friday** **30 September 2022** **1 hour 30 minutes**



**JUYING SECONDARY SCHOOL**
**END OF YEAR EXAMINATION**
**SECONDARY TWO EXPRESS/TWO NORMAL ACADEMIC (SBB)**

**READ THESE INSTRUCTIONS FIRST**

Write your name, register number, class and date in the space provided.
Write in dark blue or black pen.
You may use an HB 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 of the marks for this paper is 60.

Setter: Ms Rachel Tham
Vetter: Mrs Wong-Chia Pei San

This Question Paper consists of 15 printed pages including this page.

**Answer all questions.**

(*any wrong transfer of answers to the answer line, will result in the loss of marks)

**1.** Solve the simultaneous equations

$$2x - y = 16 \quad \text{----(1)}$$
$$2x + 3y = 25 \quad \text{----(2)}$$

| | | |
|---|---|---|
| (2)-(1): | $3y + y = 25 - 16$ | [M1:either elimination/ substitution method] |
| | $4y = 9$ | |
| | $y = 2.25$ *or* $2\frac{1}{4}$ | [A1] |
| Subst. $y = 2.25$ into (1), | | |
| | $2x - 2.25 = 16$ | |
| | $x = 9.125$ *or* $9\frac{1}{8}$ | [A1 do not accept 9.13 (3s.f.)] |

Deduct 1m if
*final answer in improper fractions
*workings correct but wrote answer as $x = 2.25$ and $y = 9.125$

*Answer* $x =$ **$9.125$ *or* $9\frac{1}{8}$**

$y =$ **$2.25$ *or* $2\frac{1}{4}$** [3]

---

**2.** $n$ is a positive integer.
Show that $(2n + 1)^2 - (2n - 3)^2$ is a multiple of 8 for all integer values of $n$.

*Answer* [3]

| | |
|---|---|
| $(2n + 1)^2 - (2n - 3)^2$ | |
| $= 4n^2 + 4n + 1 - 4n^2 + 12n - 9$ | [M1: expand either one correctly] |
| $= 16n - 8$ | [M1/ECF1: simplify to $16n - 8$] |
| $= 8(2n - 1)$ | [A1: factor 8] |

Since $n$ is a positive integer and $8(2n - 1)$, $(2n + 1)^2 - (2n - 3)^2$
Is a multiple of 8 for all integer values of $n$.

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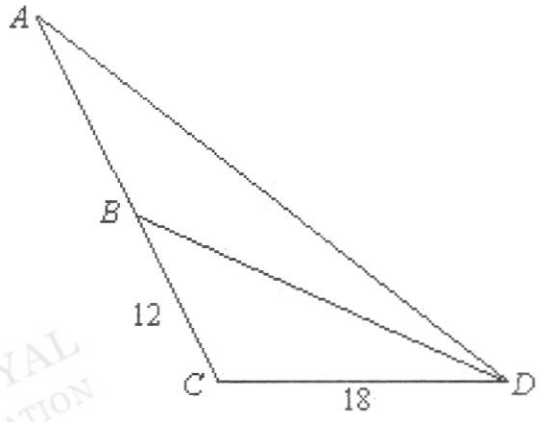
**3.** Triangle $ACD$ is similar to triangle $DCB$.
$BC = 12$ cm and $CD = 18$ cm.
Find the length of $AB$.

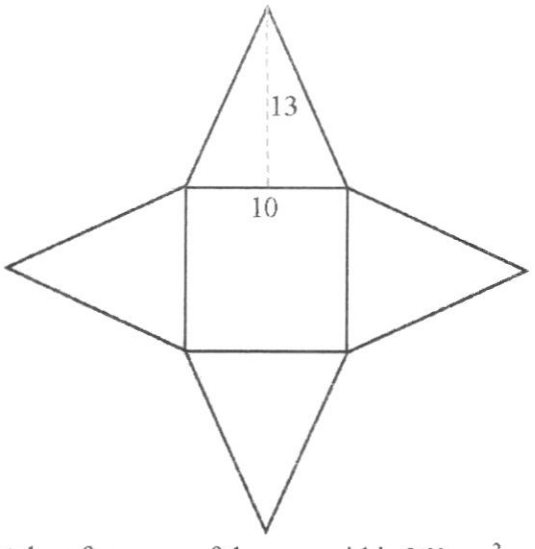



$\frac{AC}{DC} = \frac{CD}{CB}$
$\frac{AC}{18} = \frac{18}{12}$ [M1]
$AC = 27$

$AB = 27 - (12)$ [M1: allow ECF1]
$= 15$ [A1]

*Answer* ..... cm [3]

**4.** The diagram shows the net of a pyramid. It consists of a square and 4 triangles.
The length of each side of the square is 10 cm. The height of the triangle is 13 cm.




**(a)** Show that the total surface area of the pyramid is 360 $cm^2$.

*Answer* [2]

| |
|---|
| Total surface area<br>$= 10 \times 10 + 4 \times \frac{1}{2} \times 10 \times 13$ [M1: Area of Sq + 4 x Area of triangles]<br>$= 360\ cm^2$ (shown) [A1] |

**(b)** Find the volume of the pyramid.

| | |
|---|---|
| Vertical height $= \sqrt{13^2 - 5^2}$ | [M1] |
| $= 12$ cm | |
| Volume $= \frac{1}{3} \times 10^2 \times (12)$ | [M1/ ECF1] |
| $= 400\ cm^3$ | [A1] |

*Answer* ..... $cm^3$ [3]

**5.** Express as a single fraction in its simplest form.

**(a)** $\frac{9x^2}{5y^3} \div \frac{6x^3}{y^4}$

$= \frac{9x^2}{5y^3} \times \frac{y^4}{6x^3}$ [M1]

$= \frac{3y}{10x}$ [A1] or [B1: $\frac{3}{10}$, B1: $\frac{y}{x}$]

*Answer* ..... [2]

**(b)** $\frac{5x}{4} - \frac{2(5-3x)}{3}$

$= \frac{5x(3)-2(4)(5-3x)}{12}$ [M1: common denominator]

$= \frac{15x-40+24x}{12}$ [M1/ECF1: expansion, +24x]

$= \frac{39x-40}{12}$ [A1]

*Answer* ..... [3]

---

**6.** Solve the equation $\frac{5}{(x-2)} - \frac{x^2-3}{(x+1)(2-x)} = 1$

$\frac{5}{(x-2)} - \frac{x^2-3}{(x+1)(2-x)} = 1$

$\frac{5}{(x-2)} + \frac{x^2-3}{(x+1)(x-2)} = 1$ [M1]

$5(x+1) + x^2 - 3 = (x+1)(x-2)$ [M1/ECF1: eliminate denominator]

$5x + 5 + x^2 - 3 = x^2 + 2x - 2$ [M1/ECF1: expand RHS correctly]

$6x = -4$

$x = -\frac{2}{3}$ [A1]

*Answer* $x =$ ..... [4]

---

7. $y$ is directly proportional to the cube of $x$.
Given that $y = 4$ when $x = 2$, find

**(a)** an equation connecting $y$ and $x$.

$y = kx^3$
$4 = k(2)^3$ [M1]
$k = \frac{4}{8} = \frac{1}{2}$

$y = \frac{1}{2}x^3$ [A1]

*Answer* ..... [2]

**(b)** Find the value of $x$ when $y = 10$.

$10 = \frac{1}{2}x^3$

$x^3 = 20$
$x = 2.71\ (3\ s.f.)$ [B1]

*Answer* ..... [1]

**(c)** When $x$ is doubled, $y$ is eight times its original value.
Prove that the above statement is correct.

*Answer* [2]

$y_{original} = \frac{1}{2}x^3$
When $x$ is doubled
New $y = \frac{1}{2}(2x)^3$ [M1: attempt to find new $y$ when $x$ is doubled]

$= 8\,(\frac{1}{2}x^3)$
$= 8(y_{original})$ [A1]

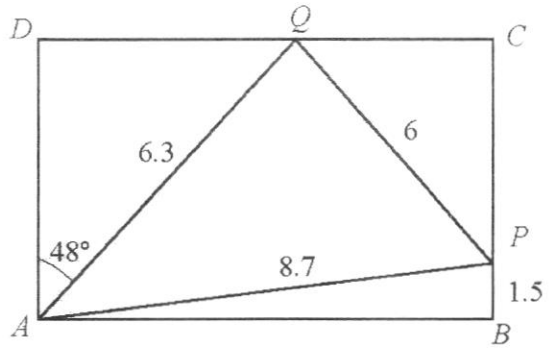
*Or*

When $x = 4$, $y = \frac{1}{2}(4)^3 = 32$ [M1: attempt to find new $y$ when $x$ is doubled]

$\frac{y_{new}}{y_{original}} = \frac{32}{4} = 8$ [A1: showing new value is 8 times original]

Do not accept : $\frac{1}{8}$

**8.** A rectangular signboard, $ABCD$, is supported by three cables, $AP$, $AQ$ and $PQ$. Given that $AP = 8.7$ m, $AQ = 6.3$ m, $PQ = 6$ m, $BP = 1.5$ m and $\angle DAQ = 48°$.




Calculate

**(a)** $AD$,

| | |
|---|---|
| $\cos 48° = \frac{AD}{6.3}$ | [M1] |
| $AD = 4.22$ cm (3 s.f.) | [A1] |
| Do not accept 1 d.p. | |

*Answer* ..... m [2]

**(b)** $\angle BAP$.

| | |
|---|---|
| $\sin \angle BAP = \frac{1.5}{8.7}$ | [M1] |
| $\angle BAP = 9.9°$ (1 d.p.) | [A1] |
| Do not accept 3 s.f. | |

*Answer* ..... ° [2]

**(c)** Show that triangle $APQ$ is a right-angled triangle.

*Answer* [2]

AP is the longest side, $AP^2 = 8.7^2$
$= 75.69$
$AQ^2 + QP^2 = 6.3^2 + 6^2$ [B1: Calculations to be done separately]
$= 75.69$

Since $AP^2 = AQ^2 + QP^2$, by the converse of Pythagoras' Theorem,
Triangle APQ is a right-angled triangle. [B1: with highlighted text]

Do not accept:
- Using $\sqrt{\ }$ in proof
- Assuming LHS = RHS right from the start

---

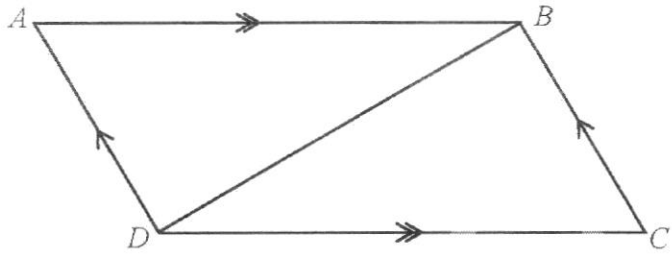
**9.** Tap $A$ takes 5 minutes to fill up a water tank.
Tap $B$ takes 7 minutes to fill up the same water tank.
Find the time, in minutes and seconds, required for both taps to fill the water tank.
Assume that both taps are turned on at the same time and the rate of water flow for each tap is constant.

Tap A: 5 min --- 1 tank
1 min --- $\frac{1}{5}$ tank
Tap B: 7 min --- 1 tank [M1: either tank]
1 min --- $\frac{1}{7}$ tank

Tap A&B: 1 min --- $(\frac{1}{5} + \frac{1}{7})$ tank [M1: allow ECF 1]
$= \frac{12}{35}$ tank
$\therefore$ full tank $= \frac{35}{12}$ min
$= 2$ min 55 s [A1]

*Answer* ..... min ..... s [3]

**10.** In the figure below, $ABCD$ is a parallelogram with $AB \,//\, DC$ and $AD \,//\, BC$.

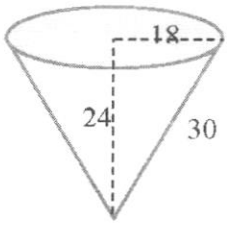



Complete the following statements for proof of congruency.

*Answer*

| | | |
|---|---|---|
| | $CD$ [B1: Do not accept DC, vertices must be in corresponding order] | |
| **(a)** | $AB =$ ..... (opposite sides of parallelogram are equal) | [1] |
| | $AD = CB$ (opposite sides of parallelogram are equal) | |
| | $BD$ is common. | |
| **(b)** | $\angle ABD = \angle CDB$ (Alt angles, $AB \,//\, DC$ [B1]) | [1] |
| | $\angle BAD = \angle DCB$ (opposite angles of parallelogram) | |
| **(c)** | $\therefore \Delta ADB$ is congruent to $\Delta$ $CBD$ [B1: vertices must be in corresponding order] | [1] |

**11.** Cally is a home-based chocolatier.
The diagram shows the dimensions, in millimetres, of the conical mould that she uses to make her chocolates.




**(a)** The mould is filled to the brim with chocolate.
Show that the total surface area of the solidified chocolate is 2710 $mm^2$, corrected to 3 significant figures.
*Answer* [3]

| | |
|---|---|
| Total surface area | |
| $= \pi(18)^2 + \pi(18)(30)$ | [M1,M1] |
| $= 2714.336$ | |
| $= 2710\ mm^2$ (3 s.f.) (shown) | [A1] |

**(b)** Calculate the volume of the chocolate, leaving your answer in terms of $\pi$.

| | |
|---|---|
| volume | |
| $= \frac{1}{3} \times \pi \times (18)^2 \times 24$ | [M1] |
| $= 2592\ \pi\ mm^3$ | [A1] |

*Answer* ..... $mm^3$ [2]

**11.** **(c)** With the same quantity of ingredients, she could also make the chocolate using a spherical mould.
Calculate the radius of the spherical mould.

$\frac{4}{3} \times \pi \times r^3 = 2592\,\pi$ [M1/ECF1]

$r^3 = 1944$

$r = \sqrt[3]{1944}$

$= 12.5\ mm\ (3\ s.f.)$ [A1]

*Answer* ..... mm [2]

**(d)** Each chocolate is wrapped tightly with a foil wrapper.
The cost of wrapper is proportional to its area used.
Assuming wastage of wrapper is negligible, justify if Cally should make her chocolates in the form of a cone or a sphere.

Surface area of sphere = $4 \times \pi \times (12.4805)^2$ [M1/ ECF1]
$= 1960\ mm^2$

Total surface area of cone = $2710\ mm^2$

∴ Cally should make her chocolate in the form of **sphere** because **the surface area of the sphere is less than that of the cone.** [A1/ECF1]

Student must clearly state "by comparing the surface area of sphere and cone "
Do not accept comparison of volume/ radius.

**12** A group of students took a test.
Their results are shown in the stem-and-leaf diagram below.

| Stem | Leaf | | | | |
|---|---|---|---|---|---|
| 0 | 8 | | | | |
| 1 | 1 | 1 | 2 | 3 | 9 |
| 2 | 4 | 4 | $x$ | 5 | 7 |

Key: 1|2 means 12

**(a)** **(i)** If the modal score is 24, find the value of $x$.

$x = 4$ [B1: do not accept 24 ]

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

**(ii)** Hence, calculate the mean score.

$$\text{mean} = \frac{8+11+11+12+13+19+24+24+24+25+27}{11} \quad \text{[M1: allow ECF]}$$

$$= \frac{198}{11} \quad \text{[or M1]}$$

$$= 18 \quad \text{[A1]}$$

*Answer* ..... [2]

**(b)** A student have to score at least 25 marks to get a distinction.
Find the fraction of students who scored a distinction.

$\frac{2}{11}$ [B1]

*Answer* ..... [1]

**13.** The table below shows the corresponding values of $x$ and $y$, where $y = -x^2 + 3x + 5$.

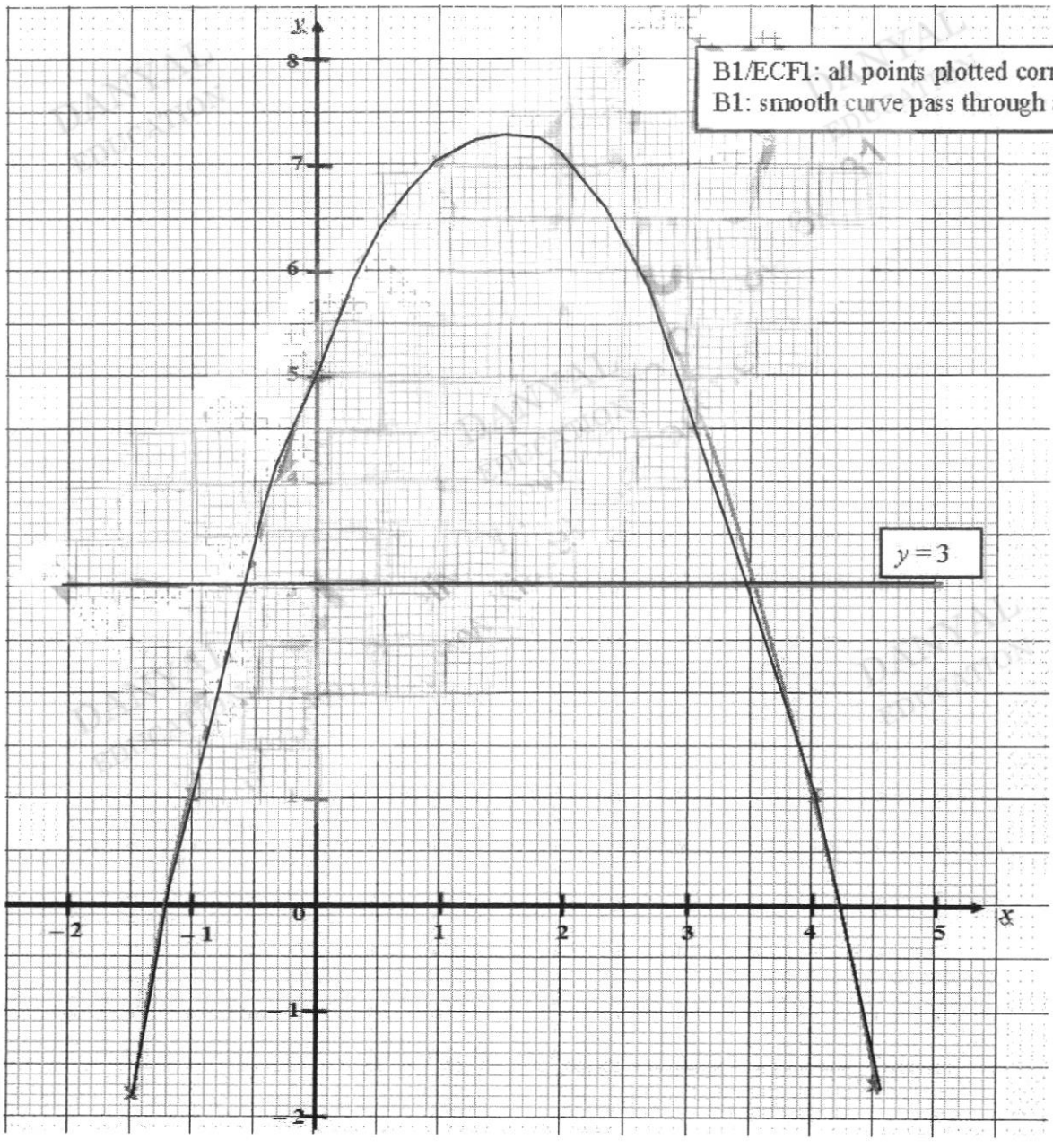
| $x$ | –1.5 | –1 | 0 | 1 | 2 | 3 | 4 | 4.5 |
|---|---|---|---|---|---|---|---|---|
| $y$ | –1.75 | $a$ | 5 | 7 | 7 | 5 | 1 | –1.75 |

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

$a = 1$ [B1]

*Answer* $a =$ ..... [1]

**(b)** On the grid, plot the graph of $y = -x^2 + 3x + 5$ for $-1.5 \leq x \leq 4.5$. [2]




B1/ECF1: all points plotted correctly
B1: smooth curve pass through all pts

**(c)** Using your graph in part **(b)**,

**(i)** find the coordinates of the turning point.

| |
|---|
| (1.5,7.25) [B1: accept y= 7.10 – 7.40] |

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

**(ii)** Draw $y = 3$ and hence, find the values of $x$ when $-x^2 + 3x + 5 = 3$

| |
|---|
| Draw $y = 3$ [B1: see graph]<br><br>$x = -0.55$ *or* 3.55 [B1,B1: accept $x = -0.45$ to 0.65 , 3.45 to 3.65] [3]<br><br>Do not accept answers by calculation (i.e.using calculator/ workings).<br>The values of $x$ must be clearly reflected on their graphs.<br>(i.e. if graph shows intersection is at x = 3.5 but student write answer as 3.5 → A0) |