Name/Student Number: _____

Teacher: _____

Sydney Technical High School

2023

YEAR 9
YEARLY EXAMINATION

Mathematics

General Instructions

- Working Time – 90 minutes
- Write using black pen

Total marks: 80

Section I MULTIPLE CHOICE— 10 marks (pages 2 - 5)

- Attempt Questions 1-10
- Use the multiple-choice answer sheet provided.
- Allow about 10 minutes for this section.

Section II — 70 marks (page 6-11)

- Attempt Questions 11-15
- Allow about 80 minutes for this section.
- Answer each question in the writing booklet.
- Start each question on a new page.

SECTION I **Multiple Choice** **(10 Marks)**

Allow approximately 10 minutes for this section.
Use the multiple-choice answer sheet for questions 1 – 10

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1. $0.000\ 003\ 46 =$

   A. 3.46×10^{-5}

   B. 3.46×10^{-6}

   C. 3.46×10^{5}

   D. 3.46×10^{6}

2. Simplify $3(k-1) - 2(k-5)$

   A. $k + 7$

   B. $k + 4$

   C. $k - 6$

   D. $k - 13$

3. Consider the following data:

   7, 8, 9, 9, 15, 18, 19, 20

   Which of the following statements is true?

   A. Median = 12

   B. Mean = 12

   C. Mode = 12

   D. Range = 12

4. $x^{\frac{4}{3}}$ is equivalent to

A. $\sqrt[4]{x^3}$

B. $\sqrt[3]{x^4}$

C. $\frac{4}{x^3}$

D. $\frac{x^4}{3}$

5. Which of the following does **not** have $(x + y)$ as a factor?

A. $x^2 + xy$

B. $y^2 + xy$

C. $x^2 + y^2$

D. $x^2 - y^2$

6. The equation of the line through (2, 3) parallel to the x axis is

A. $x = 2$

B. $x = 3$

C. $y = 2$

D. $y = 3$

7. If $4y^2 + 12y + p$ is a perfect square then the value of p is

A. 1

B. 3

C. 9

D. 36

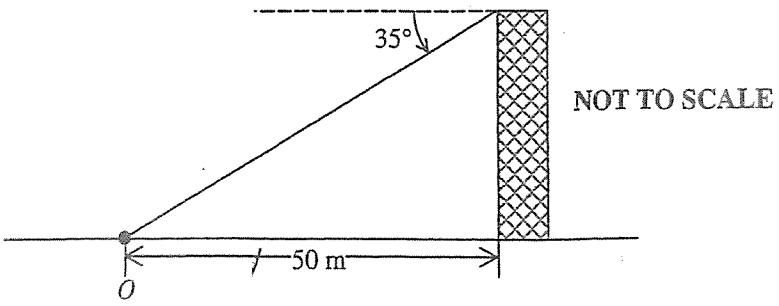
8. The angle of depression from the top of a tower to an object, *O*, on the ground is 35°. The object is 50 metres from the base of the tower. The height of the tower is closest to:

A. 29m

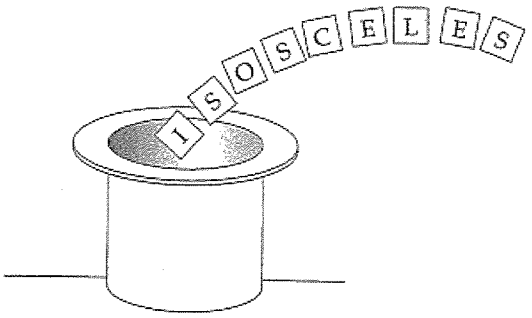
B. 35m

C. 41m

D. 71m



9. Each letter of the word *ISOSCELES* is written on a card and placed in a hat. One card is then chosen at random.



The chance of choosing an *E* is

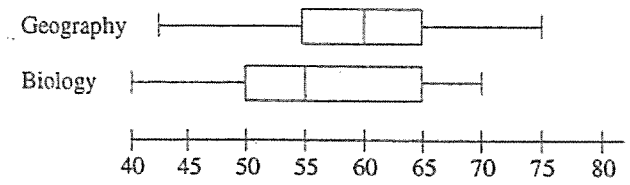
A. Double the chance of choosing an *O.*

B. Half the chance of choosing a *C.*

C. The same chance of choosing an *S.*

D. Less than the chance of choosing an *L.*

10. At Swam Bay High School, 20 students study HSC Geography and 20 students study HSC Biology. Their Trial HSC results in these subjects are shown in this double box-and-whisker plot.



Which of the following statements *must* be correct?

A. More students scored above 65 in Geography than Biology.
B. In Biology, more students scored between 55 and 65 than between 50 and 55.
C. The interquartile-range for Geography is 5 more than the interquartile-range for Biology.
D. Fifteen geography students scored the same or more in Geography than the median mark in Biology.

Section II

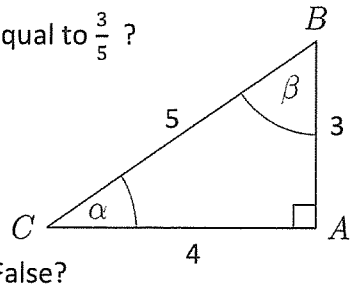
70 marks
Attempt Questions 11-15
Allow approximately 80 minutes for this section.
Answer each question in the writing booklet.

Start each question on a new page.

QUESTION 11 (14 Marks) Start a new page **Marks**

a) Evaluate $4a - 2a^2$ if $a = -3$ 1

b) Which trigonometric ratios are equal to $\frac{3}{5}$? 2



c) $\sqrt{3} + 3\sqrt{3} = \sqrt{48}$ True or False? 1

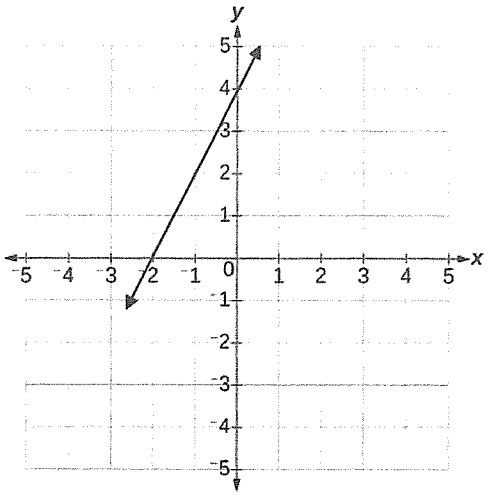
d) Solve $3x - 7 = 1 - x$ 2

e) If $tan\theta = \frac{1}{\sqrt{3}}$ find θ 1

f) Express $4p^{-3}$ without the use of a negative index 1

g) Expand and simplify $(\sqrt{5} - 1)^2$ 2

h) What is the equation of the line shown? 2



i) Rationalise the denominator of $\frac{2\sqrt{3}}{\sqrt{6}}$ 2

QUESTION 12 (14 Marks) Start a new page.

a) The point $(a, 4)$ lies on the line $2x + y - 5 = 0$ 2
Find the value of a

b) i. Factorise $a^2 - 4$ 1

ii. Factorise $a^2 - 5a + 6$ 1

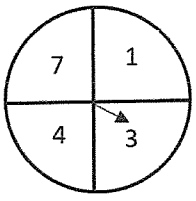
iii. Hence, simplify $\frac{a^2}{a-4} \times \frac{a^2-5a+6}{3a-a^2}$ 2

c) Factorise $6m^2 + 7m - 24$ 1

d) Find the equation of the line passing through (-1, 3) with a gradient of 2 2

e) The line l_1 has equation $y = 5x + 2$ 3
The line l_2 has equation $x + 5y - 5 = 0$
Are the lines l_1 and l_2 parallel, perpendicular or neither?
Justify your answer.

f) The arrow is spun twice. The sum of the numbers where the arrow stops is calculated.



i. What is the probability that the sum is 11? 1

ii. What is the most likely sum? 1

QUESTION 13 (14 Marks) Start a new page.

a) Expand and simplify,

$(2x+1)(2x-1)-(x+1)^2$ 2

b) Graph the line $3x-2y-12=0$ 3

You must use a ruler. Your sketch must be neat and show all important features.

c) The points A and B have coordinates (3,2) and (-3,1) respectively.

Find the

i. Midpoint of AB 1

ii. Exact length of AB 1

iii. Gradient of AB 1

iv. Equation of the line passing through A and B.
Give your answer in general form. 3

d) Make a the subject of the formula. 3

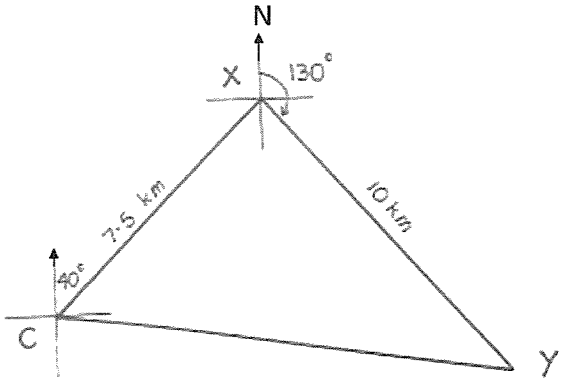
$$x=\frac{a}{a+1}$$

QUESTION 14 (14 Marks) Start a new page.

a) Simplify $\frac{3x}{(x-5)^2} - \frac{1}{x-5}$ 2

b) Show that the triangle with vertices A(0,0) , B(1,3) and C(7,1) is right-angled. 3

c) A group of students is bushwalking. They walk from their camp (C) for 7.5 km on a bearing of 040°T to X. From X they walk for 10 km on a bearing of 130°T to Y.



i. Find the size of $\angle CXY$ 1

ii. Using trigonometry find $\angle$ XCY to the nearest degree 2

iii. Find the bearing of Y from C 1

iv. How far is the group from their camp? 2

d) The mean of the 7 numbers

$x,\ 3,\ 4x-3,\ x+4,\ -16\ ,9$ and $x-4$ is 4

By forming and solving an equation find the median of these numbers. 3

QUESTION 15 (14 Marks) Start a new page

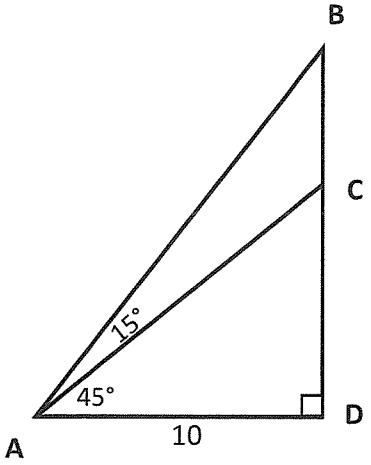
a) Solve $\frac{x}{12} - \frac{2x-1}{8} \leq \frac{5}{6}$ given x is a negative integer. 3

b) Factorise fully

i. $(a+b)^2 - 9$ 1

ii. $3x^3 - x^2 - 12x + 4$ 2

c)



Not to scale

i. Find the length AB. 2

ii. What type of triangle is ACD? 1

iii. State the length of CD 1

iv. Hence, find the length of BC as an exact value. 2

d) If $10^x = p$ find, an expression for 10^{2x-1} in terms of p. 2
Give your answer in simplest form.

END OF TEST

2023 YEAR 9 YEARLY

SECTION I

1	B	6	D
2	A	7	C
3	A	8	B
4	B	9	A
5	C	10	D

SECTION II

QUESTION 11

a) $4(-3) - 2(-3)^2$

$= -12 - 2 \times 9$

$= \underline{\underline{-30}}$

b) $\underline{\underline{\sin \alpha}}$ and $\underline{\underline{\cos \beta}}$

c) $\sqrt{3} + 3\sqrt{3}$

$= 4\sqrt{3}$

$= \sqrt{16} \times \sqrt{3}$

$= \sqrt{48}$

$\underline{\underline{\text{True}}}$

d) $3x - 7 = 1 - x$

$4x = 8$

$\underline{\underline{x = 2}}$

e) $\underline{\underline{\theta = 30^\circ}}$

f) $\underline{\underline{\frac{4}{p^3}}}$

g) $(\sqrt{5} - 1)^2$

$= 5 - 2\sqrt{5} + 1$

$= \underline{\underline{6 - 2\sqrt{5}}}$

h) $\underline{\underline{y = 2x + 4}}$

i) $\frac{2\sqrt{3}}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}}$

$= \frac{2\sqrt{18}}{6}$

$= \frac{2 \times 3 \times \sqrt{2}}{6}$

$= \underline{\underline{\sqrt{2}}}$

Student Name: _____ Teacher Name: _____

QUESTION 12

a) $2x+y-5=0$

$2a+4-5=0$

$2a-1=0$

$2a=1$

$\therefore a=\frac{1}{2}$

b) i. $(a+2)(a-2)$

ii. $(a-3)(a-2)$

iii. $\frac{a^2}{a^2-4} \times \frac{a^2-5a+6}{3a-a^2}$

$= \frac{a^2}{(a+2)(a-2)} \times \frac{(a-3)(a-2)}{a(3-a)}$

$= \frac{-a}{a+2}$

c) $(2m-3)(3m+8)$

d) $m=2 \quad (\overset{x_1}{-1}, \overset{y_1}{3})$

$y-y_1 = m(x-x_1)$

$y-3 = 2(x--1)$

$y-3 = 2(x+1)$

$y-3 = 2x+2$

$\therefore y = 2x+5$

e) $m_1 = 5$

$x+5y-5=0$

$5y = -x+5$

$y = -\frac{x}{5}+1$

$m_2 = -\frac{1}{5}$

$m_1 \times m_2 = 5 \times -\frac{1}{5}$

$= -1$

$\therefore l_1$ is perpendicular to l_2 since the gradients multiply to give -1.

f)

+	1	3	4	7
1	2	4	5	8
3	4	6	7	10
4	5	7	8	11
7	8	10	11	14

i. $P(11) = \frac{2}{16}$

$= \frac{1}{8}$

ii. 8

QUESTION 13

a) $(2x+1)(2x-1) - (x+1)^2$

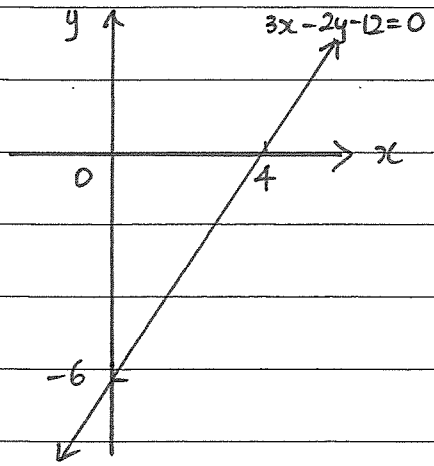
$= 4x^2 - 1 - (x^2 + 2x + 1)$

$= 4x^2 - 1 - x^2 - 2x - 1$

$= \underline{3x^2 - 2x - 2}$

b) $3x - 2y - 12 = 0$

x	0	4
y	-6	0



c) $A(3,2)$ $B(-3,1)$

$x_1\ y_1$ $x_2\ y_2$

i. $\left(\frac{3+-3}{2}, \frac{2+1}{2}\right)$

$= \underline{\left(0, \frac{3}{2}\right)}$

ii. $d = \sqrt{(-3-3)^2 + (1-2)^2}$

$= \sqrt{(-6)^2 + (-1)^2}$

$= \underline{\sqrt{37}}$

iii. $m = \frac{1-2}{-3-3}$

$= \frac{-1}{-6}$

$= \frac{1}{6}$

iv. $m = \frac{1}{6}$

$y - 2 = \frac{1}{6}(x-3)$

$y - 2 = \frac{1}{6}x - \frac{1}{2}$

$y = \frac{1}{6}x + \frac{3}{2}$

$6y = x + 9$

$\therefore \underline{x - 6y + 9 = 0}$

d) $x = \frac{a}{a+1}$

$x(a+1) = a$

$ax + x = a$

$x = a - ax$

$x = a(1-x)$

$\therefore \underline{a = \frac{x}{1-x}}$

Student Name: Teacher Name:

QUESTION 14

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

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

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

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

b) A(0,0) B(1,3) C(7,1)

$m_{AB} = \frac{3-0}{1-0}$ $m_{BC} = \frac{1-3}{7-1}$

$= 3$ $= -\frac{1}{3}$

$m_{AB} \times m_{BC} = 3 \times -\frac{1}{3}$

$= -1$

∴ AB is perpendicular to BC

∴ ΔABC is right-angled.

OR

$d_{AB} = \sqrt{(1-0)^2 + (3-0)^2}$

$= \sqrt{1^2 + 3^2}$

$= \sqrt{10}$

$d_{BC} = \sqrt{(7-1)^2 + (1-3)^2}$

$= \sqrt{6^2 + (-2)^2}$

$= \sqrt{40}$

$d_{AC} = \sqrt{(7-0)^2 + (1-0)^2}$

$= \sqrt{7^2 + 1^2}$

$= \sqrt{50}$

$(AB)^2 + (BC)^2 = \sqrt{10}^2 + \sqrt{40}^2$

$= 10 + 40$

$= 50$

$= (AC)^2$

∴ ΔABC is right angled since it satisfies Pythagoras' Theorem.

c) i. $\angle CXY = 40° + 50°$

$= 90°$

ii. $\tan \angle XCY = \frac{10}{7.5}$

$\therefore \angle XCY = 53°$

iii. $40° + 53° = 93°$

093° T

iv. $(CY)^2 = 7.5^2 + 10^2$

$= 156.25$

$\therefore CY = 12.5$ km

d) $\dfrac{x+3+4x-3+x+4-16+9+x-4}{7} = 4$

$$\frac{7x-7}{7} = 4$$

$$7x-7 = 28$$

$$7x = 35$$

$$x = 5$$

The numbers are 5, 3, 17, 9, -16, 9 and 1

In ascending order -16, 1, 3, 5, 9, 9, 17

$\therefore$ the median = 5

QUESTION 15

a) $^{24}\times\frac{x}{12} - {}^{24}\times\frac{2x-1}{8} \leq \frac{5}{6}\times 24$

$2x - 3(2x-1) \leq 20$

$2x - 6x + 3 \leq 20$

$-4x \leq 17$

$x \geqslant -\frac{17}{4}$

$x \geqslant -4\frac{1}{4}$

given x is a negative integer

$\therefore x = -4, -3, -2, -1$

d) $10^{2x-1} = 10^{x+x-1}$

$= 10^x \times 10^x \times 10^{-1}$

$= p \times p \times \frac{1}{10}$

$= \frac{p^2}{10}$

b) i. $(a+b+3)(a+b-3)$

ii. $x^2(3x-1) - 4(3x-1)$

$= (3x-1)(x^2-4)$

$= (3x-1)(x+2)(x-2)$

c) i. $\cos 60^\circ = \frac{10}{AB}$

$AB = \frac{10}{\cos 60^\circ}$

$\therefore AB = 20$

ii. right angled isosceles triangle

iii. $CD = 10$

iv. $\sin 60^\circ = \frac{BD}{20}$

$BD = 20 \sin 60^\circ$

$= 20 \times \frac{\sqrt{3}}{2}$

$= 10\sqrt{3}$

$BC = BD - CD$

$\therefore BC = 10\sqrt{3} - 10$