

HORNSBY GIRLS HIGH SCHOOL

Mathematics Advanced

Year 11 Assessment 1 - Assignment Validation Task 2024

General Instructions

- Working time – 30 minutes.
- Answer the questions in the spaces provided.
- Write using black pen, pencil may be used for graphs.
- Calculators approved by NESA may be used.
- Show relevant mathematical reasoning and/ or calculations.

Total Marks – 30 for Advanced**Part A - Algebraic Techniques**
(12 marks)**Part B – Functions**
(18 marks)

Part	A	B	Total
Total	/12	/18	/30

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Part A – Mathematics Advanced Algebraic Techniques (12 marks)

Question 1 (2 Marks)

Solve $6x^2 - 10x - 3 = 0$ using the quadratic formula. Leave your answer in exact, simplified form.

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2

Question 2 (1 Mark)

Factorise $15x^2 + x - 2$

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Question 3 (2 Marks)

Solve $\frac{2x-1}{6} - \frac{x-3}{4} = 10$

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Question 4 (2 Marks)

Find a and b such that $\frac{3\sqrt{3}+\sqrt{5}}{2\sqrt{5}}=a+b\sqrt{15}$ and a,b are real numbers.

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Question 5 (3 Marks)

Solve $9^x+3^{x+3}-28=0$

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Question 6 (2 Marks)

Simplify $\frac{12^n + 8^n}{18^n + 12^n}$

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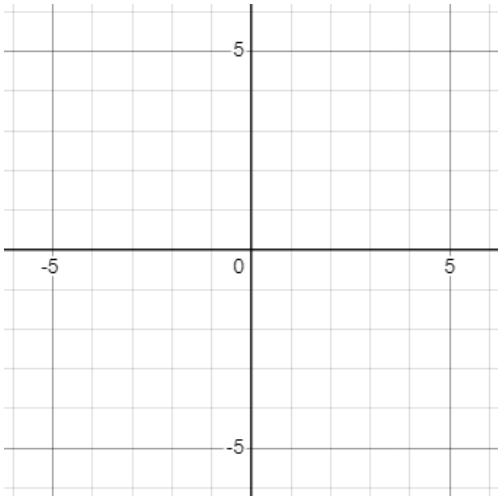
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Part B – Mathematics Advanced, Functions (18 marks)

Question 7 (1 Mark)

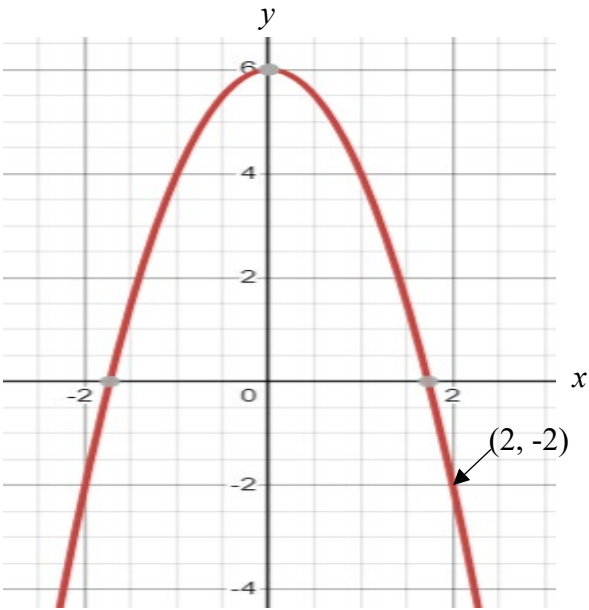
Sketch $y = 2 - 3x$



1

Question 8 (4 Marks)

a) Write the equation of the given parabola in the form $y = ax^2 + c$



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2

b) Using **interval notation**, state the range of the parabola above.

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2

Question 9 (1 Marks)

State the vertex of $y + 3 = 2(x - 1)^2$

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Question 10 (1 Mark)

Solve $8 - x^2 = 2x$, showing all algebraic working.

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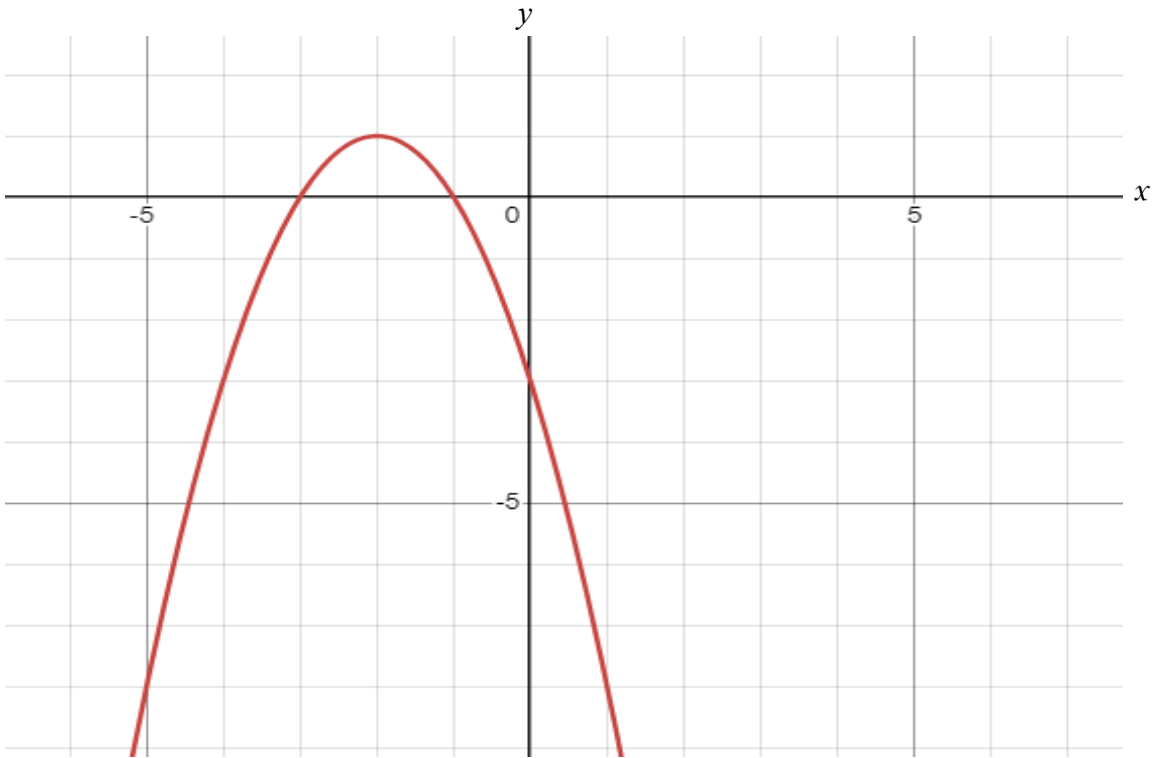
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Question 11 (2 Marks)

The graph of $y = f(x)$ is shown on the number plane below.

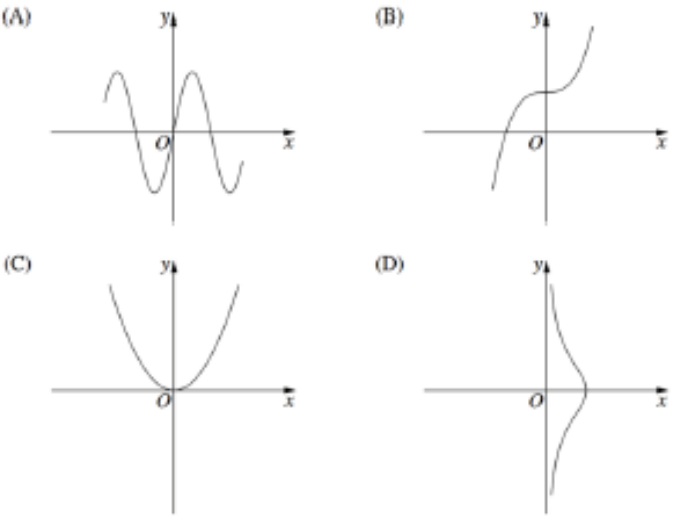
Sketch $y = f(-x)$ on the same number plane.



2

Question 12 (1 Mark)

Which graph is an even function? Circle your answer.



1

Question 13 (2 Marks)

Find the value(s) of n such that the quadratic equation $nx^2 - 2nx + 8 = 0$ has exactly one real solution.

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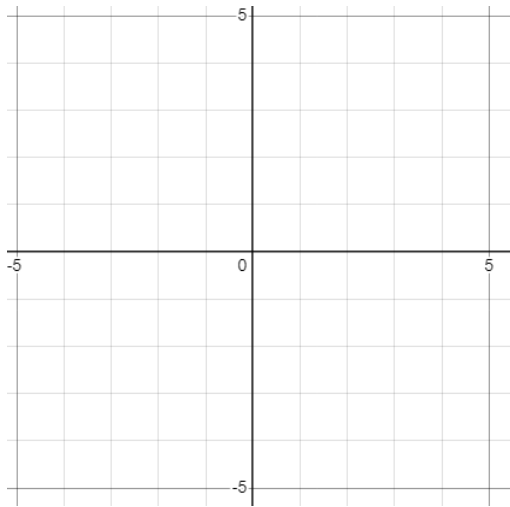
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Question 14 (6 Marks)

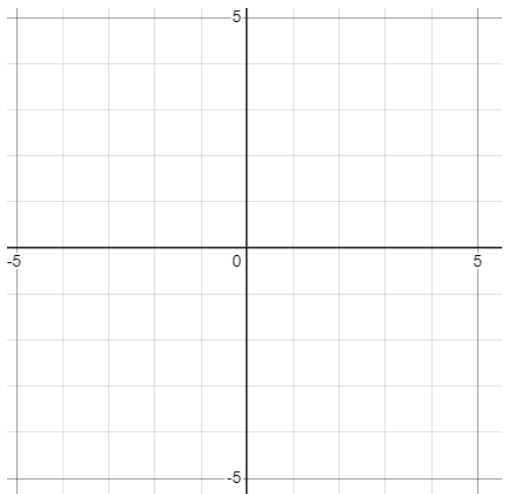
Sketch

a) $y = x(x - 3)$



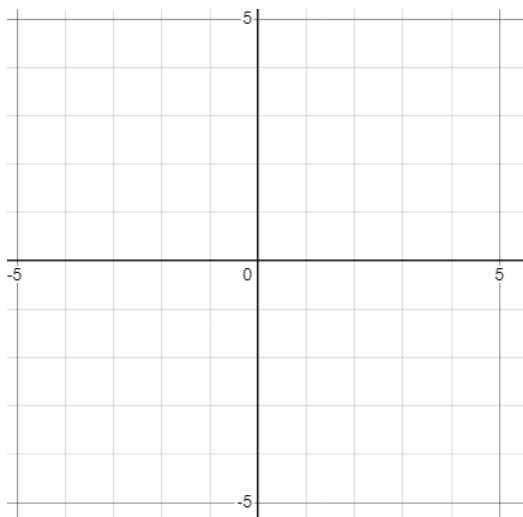
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b) $y = -x(x + 1)^2$



2

c) $y = x^2(x - 3)^2$



2

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Mathematics Advanced

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Total Marks – 30 for Advanced

Part A - Algebraic Techniques

(12 marks)

Part B – Functions

(18 marks)

Part	A	B	Total
Total	/12	/18	/30

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Part A – Mathematics Advanced Algebraic Techniques (12 marks)

Question 1 (2 Marks)

Solve $6x^2 - 10x - 3 = 0$ using the quadratic formula. Leave your answer in exact, simplified form.

$$x = \frac{10 \pm \sqrt{(-10)^2 - 4(6)(-3)}}{2(6)}$$

$$x = \frac{10 \pm \sqrt{172}}{12}$$

$$x = \frac{10 \pm 2\sqrt{43}}{12}$$

$$x = \frac{5 \pm \sqrt{43}}{6}$$

- Mostly well done.
- some students did not simplify the answer.

2

Question 2 (1 Mark)

Factorise $15x^2 + x - 2$

$$\begin{matrix} 5x+2 \\ 3x-1 \end{matrix}$$

or

$$a = -30$$

$$s = 1 \quad \therefore -5, 6$$

$$= (5x+2)(3x-1)$$

$$15x^2 - 5x + 6x - 2$$

$$= 5x(3x-1) + 2(3x-1)$$

$$= (5x+2)(3x-1)$$

Mostly well done.

1

Question 3 (2 Marks)

Solve $\frac{(2x-1)(x-3)}{6} = 10$

$$2(2x-1) - 3(x-3) = 120$$

$$4x - 2 - 3x + 9 = 120$$

$$\begin{matrix} x+7 \\ -7 \end{matrix} = 120$$

$$\therefore x = 113$$

- Mostly well done.
- Some students multiplied LCM of the denominators, but only on one side.

2

- It's better multiply both sides by LCM which is 12 rather than 24. It may take longer time if it's not LCM.

Question 4 (2 Marks)

Find a and b such that $\frac{3\sqrt{3}+\sqrt{5}}{2\sqrt{5}} = a+b\sqrt{15}$ and a, b are real numbers.

$$\begin{aligned} & \frac{3\sqrt{3}+\sqrt{5}}{2\sqrt{5}} \times \frac{\sqrt{5}}{\sqrt{5}} \\ &= \frac{3\sqrt{15}+5}{2\sqrt{5} \cdot \sqrt{5}} \\ &= \frac{3\sqrt{15}+5}{2 \cdot 5} \\ &= \frac{3\sqrt{15}}{10} + \frac{5}{10} \\ &= \frac{3\sqrt{15}}{10} + \frac{1}{2} \\ \therefore a &= \frac{1}{2}, b = \frac{3}{10} \end{aligned}$$

- mostly well done.
- some students multiplied both numerator and denominator by $2\sqrt{5}$. Doing this just ends up spending time to simplify.
- multiplying $\sqrt{5}$ is sufficient.

2

Question 5 (3 Marks)

Solve $9^x + 3^{x+3} - 28 = 0$

$$\begin{aligned} & (3^x)^2 + 3^x \times 3^3 - 28 = 0 \\ & (3^x)^2 + 27(3^x) - 28 = 0 \\ & \text{let } u = 3^x \\ & u^2 + 27u - 28 = 0 \\ & (u+28)(u-1) = 0 \\ & \therefore u = -28, u = +1 \\ & 3^x = -28, 3^x = 1 \\ & \text{no solution } \therefore u = 0 \end{aligned}$$

- There were some students who were not able to recognise the quadratic equation by substituting $3^x = u$. More practising is needed.
- Some students did not ~~show~~ stated ~~not~~ "no solution" for $3^x = -28$.
- some students did not solve for x .
- The answer is not -28 and 1 .

3

Question 6 (2 Marks)

Simplify $\frac{12^n + 8^n}{18^n + 12^n}$

$$= \frac{3^n \times 4^n + 2^n \times 4^n}{3^n \times 6^n + 2^n \times 6^n}$$

or equivalent 1

$$= \frac{4^n (3^n + 2^n)}{6^n (3^n + 2^n)}$$

$$= \frac{4^n}{6^n}$$

$$= \left(\frac{2}{3}\right)^n \quad \text{or} \quad \frac{2^n}{3^n}$$

2

• poorly done question
more than half of the students
could not factorise & simplify

• some students coincidentally
arrived at the answer by 2
incorrect mathematical process

$$\text{of } \frac{12^n + 8^n}{18^n + 12^n} = \frac{20^n}{30^n} \quad \text{XXX!}$$

$$= \left(\frac{20}{30}\right)^n$$

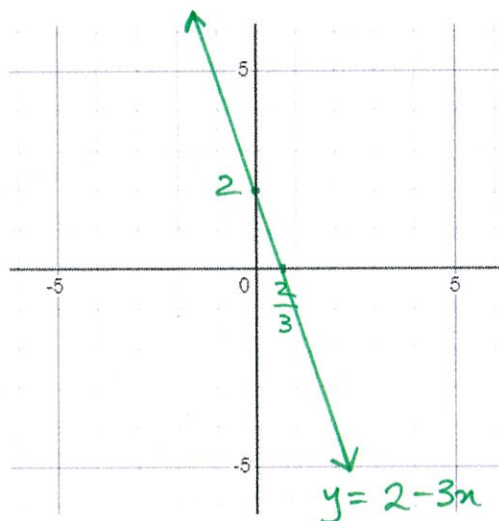
$$= \left(\frac{2}{3}\right)^n$$

This was awarded no
marks.

Part B – Mathematics Advanced, Functions (18 marks)

Question 7 (1 Mark)

Sketch $y = 2 - 3x$



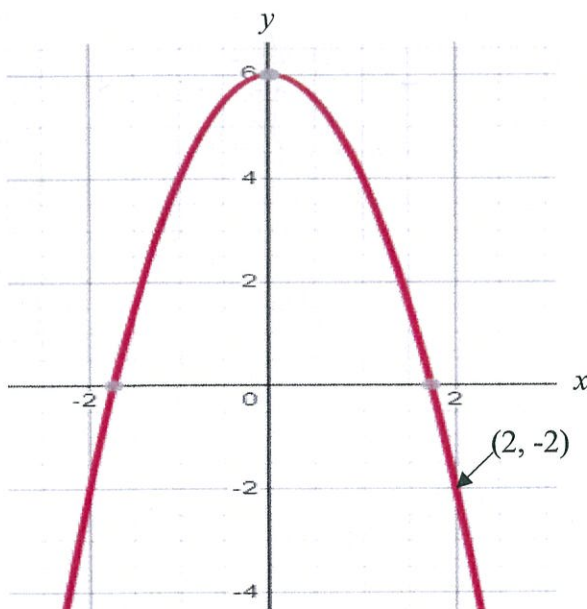
$y\text{-int} : y = 2$
 $x\text{-int} : 0 = 2 - 3x$
 $3x = 2$
 $x = \frac{2}{3}$

① • mostly well done

1

Question 8 (4 Marks)

a) Write the equation of the given parabola in the form $y = ax^2 + c$



$y = ax^2 + c$ ①
 $-2 = a(2)^2 + 6$
 $-8 = 4a$
 $\therefore a = -2$
 $\therefore y = -2x^2 + 6$ ①
 or $y = 6 - 2x^2$

• mostly well done
quite a few incorrect a values

2

b) Using interval notation, state the range of the parabola above.

Range : $(-\infty, 6]$

• mostly well done
 • some students had numbers back to front, or symbols wrong.
 • some did not use interval notation

2

Question 9 (1 Marks)

State the vertex of $y + 3 = 2(x - 1)^2$

Vertex : $(1, -3)$ ①

• mostly well done
 • some back to front or wrong signs e.g. $(-3, 1)$
 $(-1, 3)$

1

Question 10 (1 Mark)

Solve $8 - x^2 = 2x$, showing all algebraic working.

$$x^2 + 2x - 8 = 0$$

$$(x + 4)(x - 2) = 0$$

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

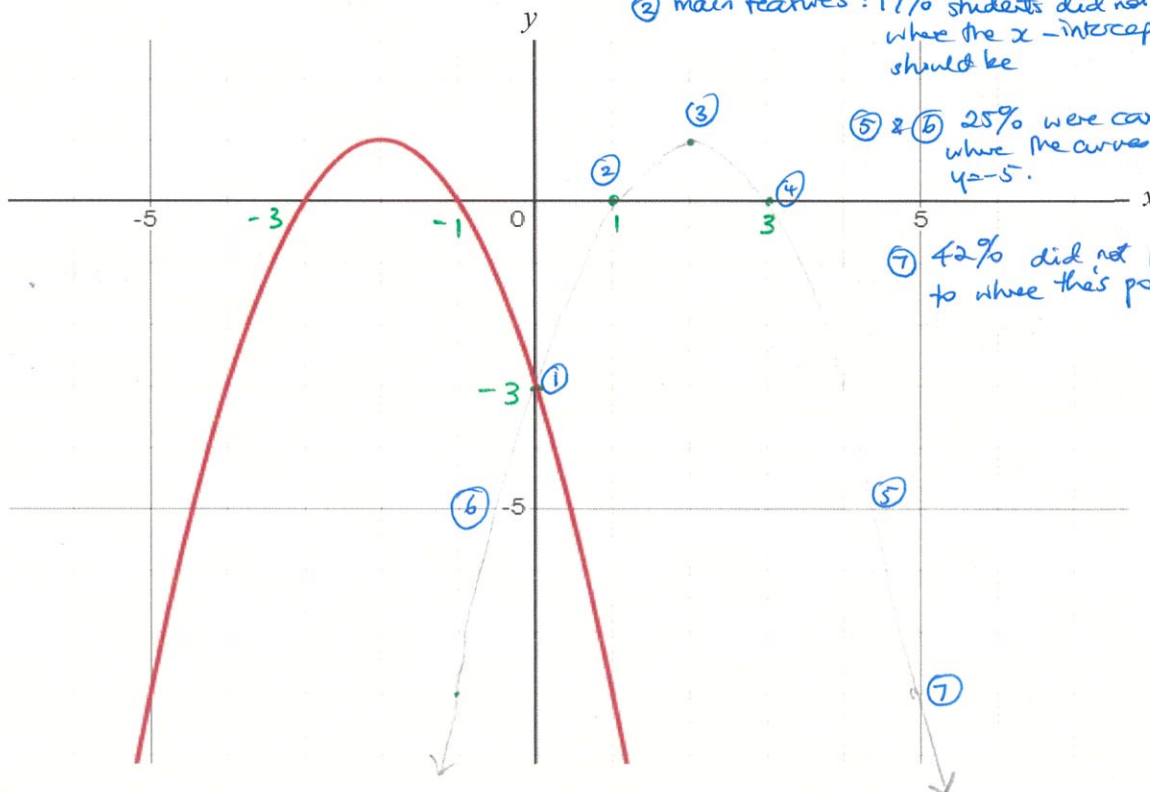
- mostly well done
- a few did not know how to factorise or stopped after factorising.

1

Question 11 (2 Marks)

The graph of $y = f(x)$ is shown on the number plane below.

Sketch $y = f(-x)$ on the same number plane.



Students have been missing details, especially where when grid is provided, no excuse for missing the following data:

① main feature: 12% students did not pay attention to where the y-intercept is and drew above or below, missing that important point.

② main features: 17% students did not pay attention where the x-intercepts of $y = f(x)$ should be

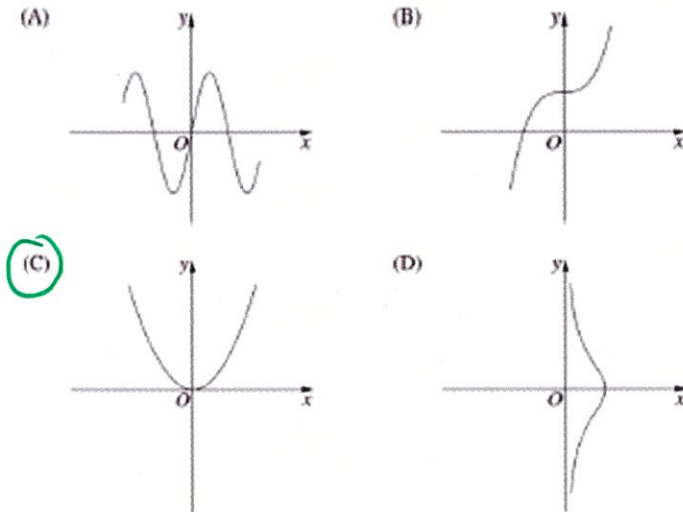
⑤ & ⑥ 25% were careless with where the curve crosses the line $y = -5$.

⑦ 42% did not pay attention to where this point should be.

2

Question 12 (1 Mark)

Which graph is an even function? Circle your answer.



1

Mostly done well. (98% got correct)

Question 13 (2 Marks)

Find the value(s) of n such that the quadratic equation $nx^2 - 2nx + 8 = 0$ has exactly one real solution.

$$nx^2 - 2nx + 8 = 0$$

$$\Delta = b^2 - 4ac = 0 \text{ for exactly one solution}$$

$$(-2n)^2 - 4(n)(8) = 0$$

$$4n^2 - 32n = 0$$

$$4n(n - 8) = 0$$

$$\therefore n = 0, n = 8$$

but $n = 0$ would not produce a quadratic equation

$$\therefore n = 8 \text{ only}$$

2

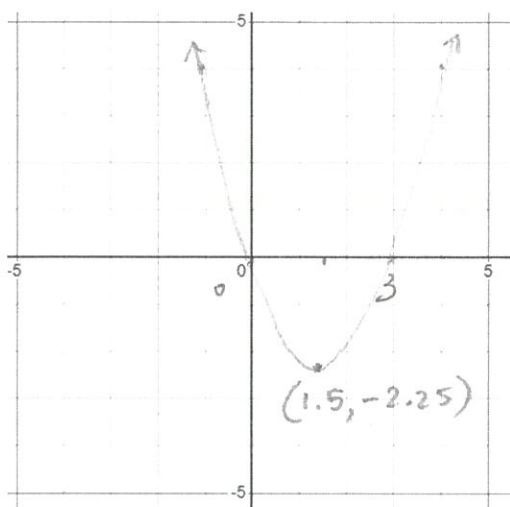
- A few had wrong discriminant formula.
- 36% did not explain why $\Delta = 0$ or the reason for using $\Delta = 0$.
- 59% did not realise that n cannot equal 0.
- The few that rejected $n = 0$ did not explain why.

Question 14 (6 Marks)

Sketch

Very disappointing that 73% of submitted work did not label the x and y axes of the graphs given below.

a) $y = x(x-3)$

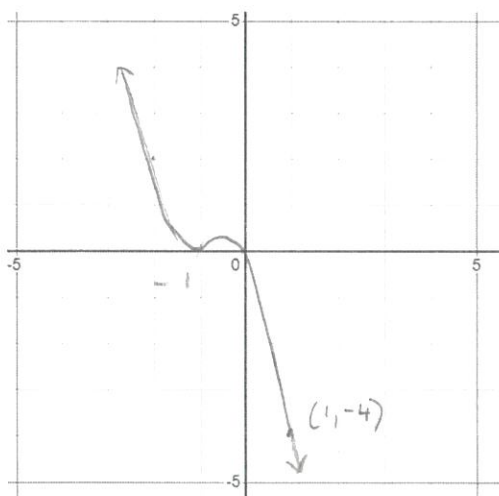


Mostly well done.

A few students did not label the coordinates of the turning point. Some did not use the given scale to sketch the turning point at the appropriate position.

A few students need to improve the shape of the parabola sketched. 2

b) $y = -x(x+1)^2$

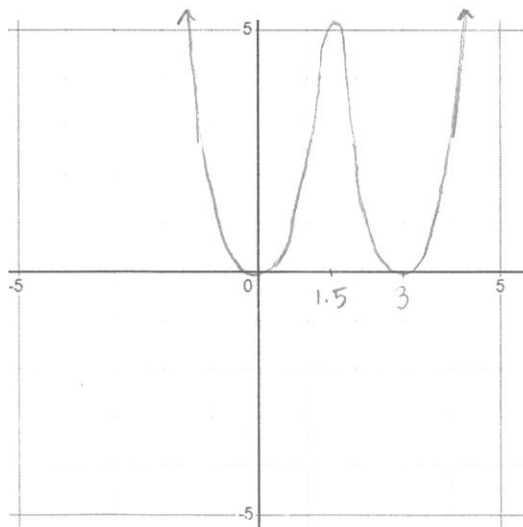


Most students did well.

Some students had the perfect root at 0 rather than -1. Many students (41%) of cohort did not plot (1, -4) and drew the cubic curve wide.

19% of cohort need to learn how to sketch this function. 2

c) $y = x^2(x-3)^2$



- Most students knew the shape of the function, but did not pay attention to sketching appropriate points and sketched very wide curves.
- 69% of student did not use $x=1.5$ to estimate where the turning point should be, hence sketch turning points below $y=5$ and some were very low.

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Advise students to pay attention to details in future especially when grids are provided.

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