Student Number: ..... Teacher Name: .....

# PENRITH SELECTIVE HIGH SCHOOL

# MATHEMATICS DEPARTMENT

## Year 11 Assessment Task 1
## 2025
## Mathematics Extension 1

**General Instructions:**

- Reading time – 10 minutes
- Working time – 1 hour 15 minutes
- Write using black pen
- Calculators approved by NESA may be used
- A reference sheet is provided with this examination paper
- For questions in Section II, show relevant mathematical reasoning and/or calculations
- No correction tape/white out allowed.

**Total marks: 62**

**Section I – 10 marks** (pages 1–4)

- Attempt Questions 1–10
- Allow about 15 minutes for this section

**Section II – 52 marks** (pages 5–8)

- Attempt Questions 11–14
- Allow about 1 hour for this section

| | Multiple Choice | Q11 | Q12 | Q13 | Q14 | TOTAL |
|---|---|---|---|---|---|---|
| **Inequalities** | 5, 6, 7, 8, 9 /5 | a, b /8 | a, b /5 | a /3 | c, d /8 | /29 |
| **Inverse Functions** | 1, 2, 3, 4, 10 /5 | c, d /5 | c, d /8 | b /10 | a, b /5 | /33 |
| **TOTAL** | /10 | /13 | /13 | /13 | /13 | /62 |
| | | | | | | **%** |

## Section I

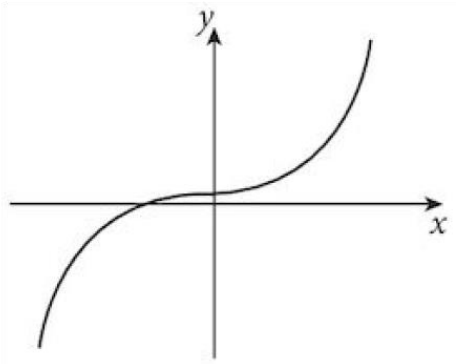
**10 marks**
**Attempt Questions 1–10**
**Allow about 15 minutes for this section**

Use the multiple-choice answer sheet for Questions 1–10.

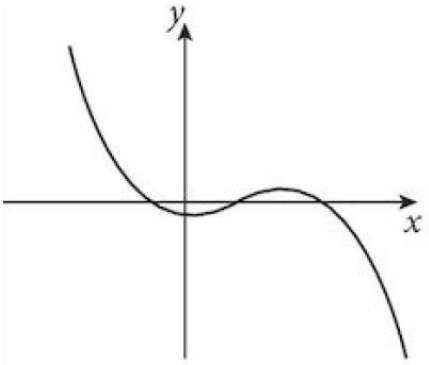
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1. Which of the following function represented by each graph does **NOT** have an inverse function?

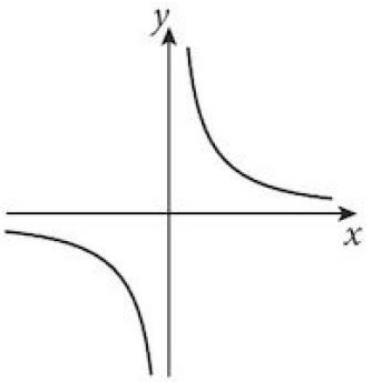
A.



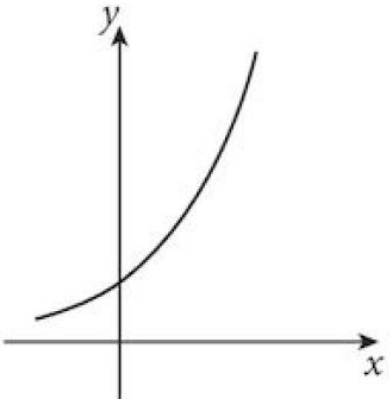

B.




C.




D.




2. For $f(x)=2x-7$, $f^{-1}(x)=$

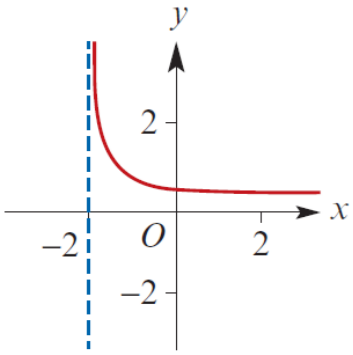
A. $2x+7$

B. $\frac{1}{2}x+7$

C. $\frac{1}{2}x+\frac{7}{2}$

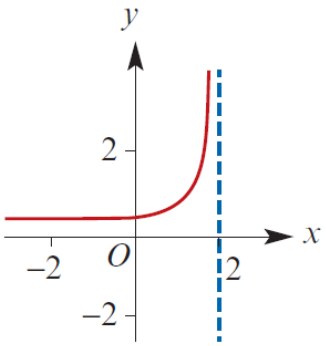
D. $\frac{1}{2x-7}$

3. The graph of the function $f$ is shown below.

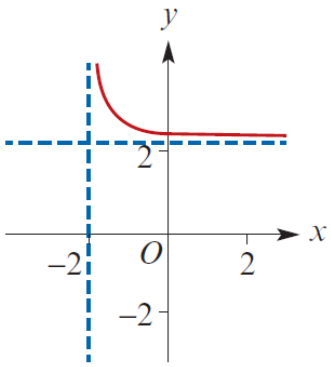



Which one of the following is most likely to be the graph of the inverse function of $f$?

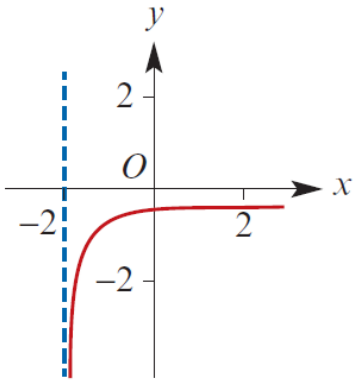
A.



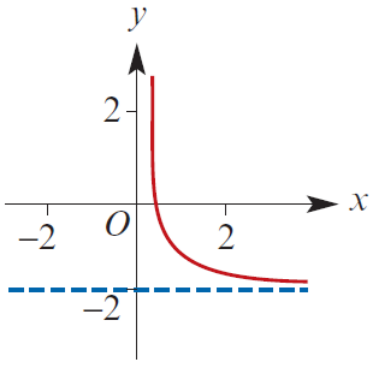

B.




C.




D.




4. Which of the following relation is a function whose inverse is **NOT** a function?

A. A one-to-one relation

B. A one-to-many relation

C. A many-to-one relation

D. A many-to-many relation

5. Solve $|8x-1| \le 15$.

A. $-2 \le x \le \frac{7}{4}$

B. $x \le -\frac{7}{4} \cup x \ge 2$

C. $x \le 2 \cup x \ge -\frac{7}{4}$

D. $-\frac{7}{4} \le x \le 2$

6. If the quadratic equation $x^2 + (k-1)x = 2k+1$ has **NO** real roots, find the values of $k$.

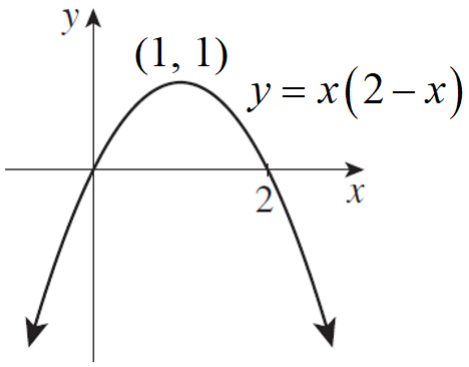
A. $k < 1$ or $k > 5$

B. $-5 < k < 1$

C. $-5 < k < -1$

D. $k < -5$ or $k > -1$

7. The graph of $y = x(2-x)$ is shown below.
Which of the following represents the solution to $x(2-x) < 1$?



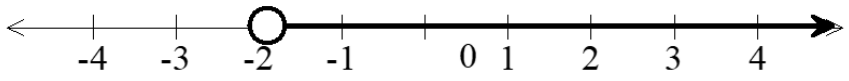

A. $(-\infty, \infty)$

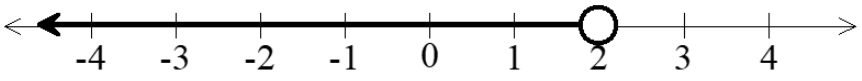
B. $(-\infty, 1) \cup (1, \infty)$

C. $(-\infty, 0) \cup (2, \infty)$

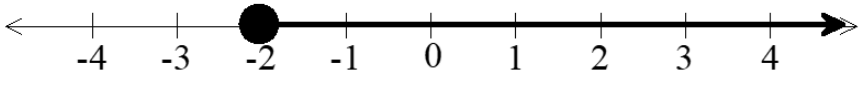
D. $(0, 2)$

8. Which of the following graphs represents the solution of $\frac{7x+1}{3} < \frac{3x+4}{2}$?

A. 


B. 


C. 


D. 


9. Which of the following represents the domain of $f(x) = \frac{2-x}{\sqrt{4-x^2}}$?

A. $(-2, 2)$

B. $[-2, 2]$

C. $(-2, 2]$

D. $(-\infty, -2] \cup [2, \infty)$

10. Which of the following represents the inverse **relation** of $y = ax^2 + bx + c$?

A. $f^{-1}(x) = \frac{-b \pm \sqrt{b^2 - 4a(c-x)}}{2a}$

B. $f^{-1}(x) = \frac{-b \pm \sqrt{b^2 - 4a(c+x)}}{2a}$

C. $f^{-1}(x) = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

D. $f^{-1}(x) = \frac{-b \pm \sqrt{b^2 - 4acx}}{2a}$

## Section II

**52 marks**
**Attempt Questions 11–14**
**Allow about 1 hour for this section**

Answer each question in the appropriate writing booklet. Extra writing booklets are available.

In Questions 11–14, your responses should include relevant mathematical reasoning and/or calculations.

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**Question 11** (13 marks) Use a separate Writing Booklet for Question 11.

(a) Solve $\frac{1}{3}x-\frac{3(x-4)}{4}\geq\frac{5}{6}$. **3**

(b) A function is defined by the equation $y=\frac{x+3}{x-4}$.

(i) Show that $\frac{x+3}{x-4}=1+\frac{7}{x-4}$. **1**

(ii) Draw the graph of $y=\frac{x+3}{x-4}$ showing the vertical and horizontal asymptotes. **2**

(iii) Hence or otherwise, find the values of $x$ for which $\frac{x+3}{x-4}<2$. **2**

(c) Show that the inverse **relation** of $x^2-14x+y^2+2y+25=0$ is $(x+1)^2+(y-7)^2=25$. **3**

(d) Explain what type of functions will always have an inverse function without imposing a domain restriction to the original function? Give an example. **2**

**End of Question 11**

**Question 12** (13 marks) Use a separate Writing Booklet for Question 12.

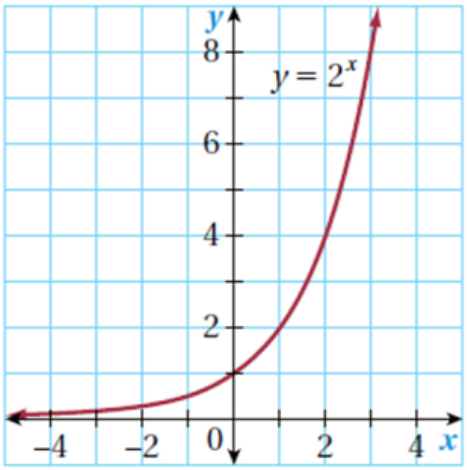
(a) Solve $|5x-2|+6 \geq 19$. **2**

(b) Sketch the graph of $y=(x+4)(x-1)(x-3)$. Hence or otherwise, solve $(x+4)(x-1)(x-3)<0$. **3**

(c) The graph shows the function $y=2^x$. **2**

Suppose the domain was restricted to $\{-2 \leq x \leq 3\}$.

What is the domain of the inverse function for this restricted function?




(d) Consider the function $f(x)=\sqrt[3]{x}$.

(i) Find $f^{-1}(x)$. **1**

(ii) On the same set of axes, draw the graphs of both the function and its inverse. **2**

(iii) Hence or otherwise, find all the points of intersection of the function and its inverse. **3**

**End of Question 12**

**Question 13** (13 marks) Use a separate Writing Booklet for Question 13.

(a) Solve $\frac{4}{3x-1} \leq 1,\ x \neq \frac{1}{3}$. **3**

(b) Consider the function $f(x) = x^2 - 4x - 5$.

(i) State the coordinates of the vertex of the parabola. **1**

(ii) Explain why the domain of the function $f(x)$ must be restricted if $f(x)$ is to have an inverse function. **1**

(iii) Find the largest domain that includes the *y*-intercept such that the graph defines a function, $f(x)$, for which an inverse function exists. **1**

(iv) Find the inverse function and state its domain and range. **3**

(v) Sketch the graphs of $f(x)$ with the restricted domain and its inverse on the same axes. **2**

(vi) Hence, find the coordinates of the point of intersection of the two curves $y = f(x)$ and $y = f^{-1}(x)$. **2**

**End of Question 13**

**Question 14** (13 marks) Use a separate Writing Booklet for Question 14.

(a) Given that $f(x) = 2x + 5$, where $x \geq 1$, find the equation of $f^{-1}(x)$ and its domain. **2**

(b) Find the equation of $f^{-1}(x)$ given that $f(x) = \frac{2}{3}\sqrt{x}$, then verify that $f^{-1}(f(x)) = x$ and $f(f^{-1}(x)) = x$. **3**

(c) Sketch the graph of $y = x^3(x-2)^2(x+3)$. Hence or otherwise, solve $x^3(x-2)^2(x+3) > 0$. **4**

(d) (i) On the same axes sketch $y = 2 - |x|$ and $y = \frac{1}{2}x$. **2**

(ii) Hence solve $|x| + \frac{1}{2}x < 2$. **2**

**END OF PAPER**