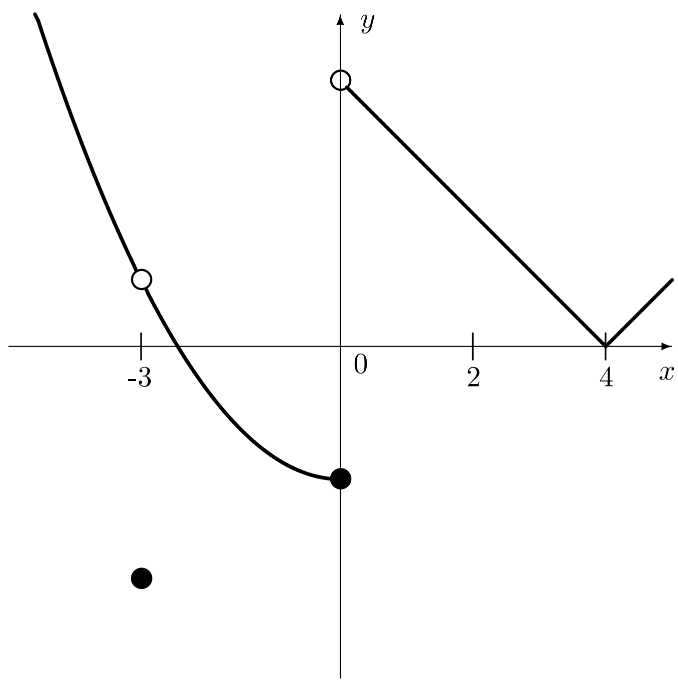
MEMORIAL UNIVERSITY OF NEWFOUNDLAND

DEPARTMENT OF MATHEMATICS AND STATISTICS

TEST 2 **MATHEMATICS 1000-001** OCTOBER 24TH, 2023

| **Name** | **MUN Number** |
|---|---|

[12] 1. Use the graph of $y = f(x)$ below to determine each of the following. When asked to classify a discontinuity, you should indicate whether it is removable or non-removable.




(a) Is $f(x)$ continuous at $x = -3$? If not, classify the discontinuity.

(b) Is $f(x)$ differentiable at $x = -3$? If not, briefly explain why.

(c) Is $f(x)$ continuous at $x = 0$? If not, classify the discontinuity.

(d) Is $f(x)$ differentiable at $x = 0$? If not, briefly explain why.

(e) Is $f(x)$ continuous at $x = 2$? If not, classify the discontinuity.

(f) Is $f(x)$ differentiable at $x = 2$? If not, briefly explain why.

(g) Is $f(x)$ continuous at $x = 4$? If not, classify the discontinuity.

(h) Is $f(x)$ differentiable at $x = 4$? If not, briefly explain why.

[5] 2. Identify any horizontal asymptotes of the graph of $f(x) = \dfrac{x^3(5-6x)}{(3x^2+1)^2}$.

3. Consider the function $f(x) = x^2 - 4x + 7$.

[7] (a) Use the <u>limit definition</u> of the derivative to find $f'(x)$.

[3] (b) Find the equation of the line that is tangent to the curve $y = x^2 - 4x + 7$ at $x = 1$.

[13] 4. Consider the function

$$f(x) = \begin{cases} \dfrac{x+2}{x^2-1}, & \text{for } x < 0 \\ 3x+8, & \text{for } x = 0 \\ \dfrac{x^2-4x+4}{x-2}, & \text{for } x > 0 \end{cases}$$

(a) Use the definition of continuity to determine whether $f(x)$ is continuous at $x = 0$. If it is not, is the discontinuity removable or non-removable?

(b) Use the definition of continuity to determine all other points at which $f(x)$ is not continuous. Classify any discontinuities as removable or non-removable.

[40]