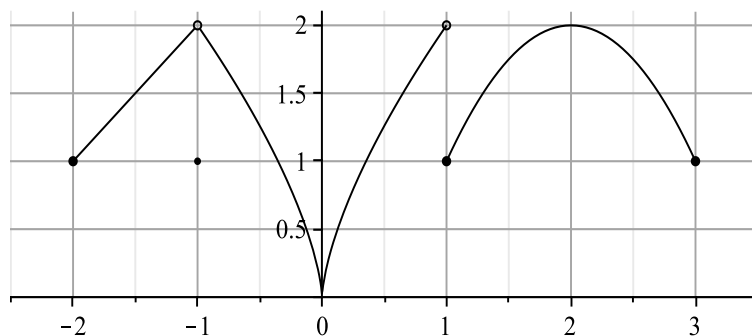


This test consists of 100 points and 5 pages, none of which is intentionally left blank. Take a few seconds right now to be sure you have all the pages. The point value of each question is to the left of the question number. Show all your work in the space provided. If you run out of room for an answer, continue working on the back of the page. Your answers must be justified by your work.

NO GRAPHING CALCULATORS

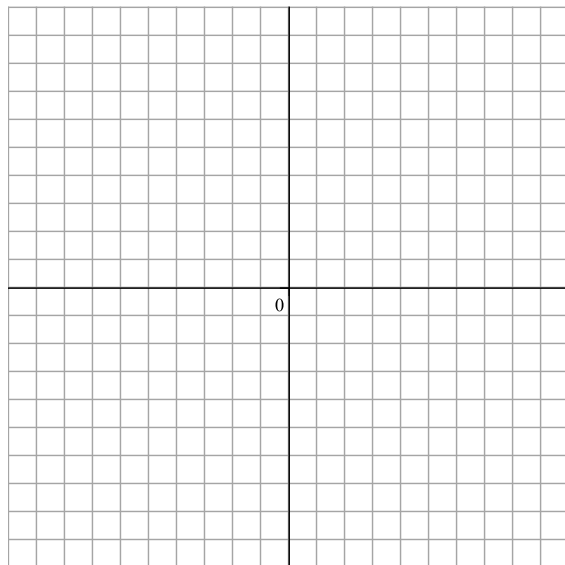
- (10) 1. The graph of a function $y = f(x)$ is given below.



On the grid below, sketch a graph of

$$y - 1 = f\left(\frac{x + 2}{2}\right).$$

Be sure to label the scale on the horizontal and vertical axes.



2. Simplify the following logarithms

(5) (a) $25^{\log_5(3x^2)}$

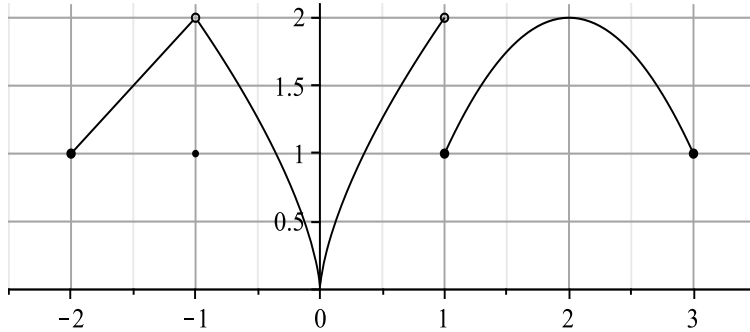
(5) (b) $\ln(8x + 4) - 2\ln(2)$ (Write as a single logarithm)

(5) 3. Use an appropriate trigonometric identity to write $\sin(x + \pi/3)$ in terms of $\sin(x)$ and $\cos(x)$.

(10) 4. Write an ε - δ proof to show

$$\lim_{x \rightarrow 6} \left(4 - \frac{x}{3}\right) = 2$$

5. The parts of this problem refer to the graph below.



- (5) (a) Evaluate $\lim_{x \rightarrow -1} f(x)$
- (5) (b) Evaluate $\lim_{x \rightarrow 1^-} f(x)$
- (5) (c) Evaluate $\lim_{x \rightarrow 1^+} f(x)$
- (5) (d) For what values of x is f discontinuous?
- (5) (e) For what values of x does f not have a derivative?

(10) 6. Suppose

$$\lim_{x \rightarrow 5} \frac{f(x) - 3}{x - 5} = 2$$

Give a convincing argument why

$$\lim_{x \rightarrow 5} f(x) = 3$$

7. Evaluate the following limits.

$$(5) \quad (a) \lim_{x \rightarrow 3} \frac{\sqrt{x+6} - 3}{x+3}$$

$$(5) \quad (b) \lim_{x \rightarrow -\infty} \frac{x}{\sqrt{x^2 + 2x + 3}}$$

$$(5) \quad (c) \lim_{x \rightarrow 3} \frac{\frac{1}{x^2} - \frac{1}{9}}{x-3}$$

(5) (d) $\lim_{x \rightarrow 2^-} \frac{x^2 - 4x + 1}{2 - x}$

(10) 8. Find an equation of the line tangent to the graph of $f(x) = \sqrt{x}$ at the point $(9, 3)$.