

Instructions: Here you go. It's your opportunity to show me how hard you've been working so far. Before you begin, say "I can do this." Out loud. Like you mean it. Then get started. (No calculators, no looking at other people's work, etc.) Don't forget to read the directions to each problem. Some ask for mathematical answers (with your work shown), some ask for explanations, some ask for graphs.

1. Find an equation for the line which passes through the points $(4, 6)$ and $(\pi, 3(\pi - 2))$. Give your answer in slope-intercept form.

Find the center of the circle given by the equation

$$4x^2 - 12x + 4y^2 - 8y + 10 = 0.$$

2. Explain the meaning of

$$\lim_{x \rightarrow 4} f(x).$$

Find the following limit, giving a reason for each step in your calculation:

$$\lim_{x \rightarrow 4} \frac{x^2 - 4x}{x - 4}.$$

3. For a function $f(x)$, we define the derivative of f at x_o as

$$f'(x_o) = \lim_{\Delta x \rightarrow 0} \frac{f(x_o + \Delta x) - f(x_o)}{\Delta x}.$$

Explain why this formula gives the slope of the tangent line to the graph of f at x_o . (It might help to draw a picture.)

4. Given $f(x)$, calculate $f'(x_o)$ using the definition of the derivative.

$$f(x) = \frac{2}{x^2}$$

$$f(x) = -3x^2 + 10x$$

5. Given the graph of $g(x)$ on the right, calculate the following values:

$$\lim_{x \rightarrow 1} g(x) = \qquad g(1) =$$

$$\lim_{x \rightarrow 3} g(x) = \qquad \lim_{x \rightarrow \infty} 2 \cdot g(x) =$$

$$g(3) = \qquad \lim_{x \rightarrow 4} g(x) =$$

$$\lim_{x \rightarrow 2} \frac{g(x)}{g(x + 1)} =$$

What does it mean for a function to be continuous at a point? Give two definitions: a formal mathematical definition and one which captures how you think about it.

Definition 1:

Definition 2:

Name all the points at which $g(x)$ (the function shown above) is discontinuous.

6. Take derivatives of the following functions. (Note: e is an important constant which is approximately 2.71828.)

$$f(x) = 2365ex^{17}$$

$$g(z) = (z^2 + 4)(51z^3 + 2z^2 - \pi z + 1)$$

$$h(t) = \frac{t^2 + 3t + 2}{t^2 - 3t - 4} \text{ (For this one, you must simplify your answer.)}$$

$$k(s) = \frac{1}{\sqrt{s}(2s^2 + 19)}$$

Extra Credit: Name the highest point on each continent.