

Standard Response Questions. Show all work to receive credit. Please **BOX** your final answer.

1. Calculate the first derivative of the following functions.

(a) (4 points) $f(x) = \sqrt[3]{x} + \frac{1}{x^2}$

(b) (4 points) $g(x) = \frac{3x^4}{\tan x}$

(c) (6 points) $h(x) = \cos^3 x$

2. Let $f(x) = -x(x - 4) = -x^2 + 4x$ to answer the following questions:

(a) (4 points) Calculate the average rate of change of f over the interval $[1, 2]$.

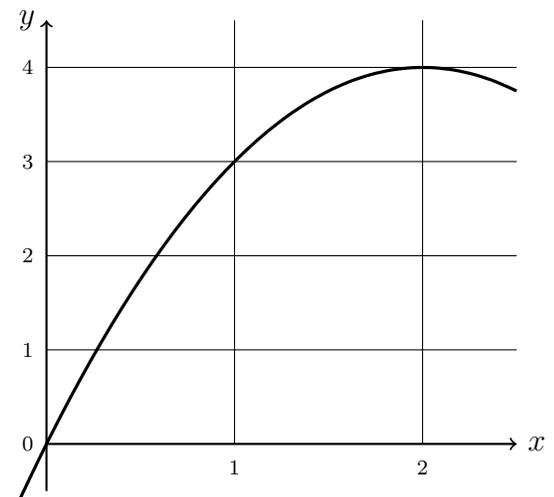
(b) (6 points) Calculate $f'(1)$ using the **definition** of the derivative. (*other methods will receive 0pts*)

(c) (2 points) Write an equation of the tangent line through the point $(1, f(1))$.

(d) (2 points) Use the graph on the right to sketch:

- a secant line through $(1, f(1))$ and $(2, f(2))$
- a tangent line through the point $(1, f(1))$

Results from parts (a)-(c) might be helpful.



3. Use the graph of $f(x)$ shown below to answer the following questions.

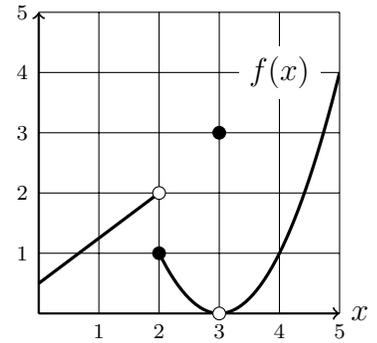
(a) (4 points) Evaluate the limits:

$$\lim_{x \rightarrow 2^+} f(x) =$$

$$\lim_{x \rightarrow 2} f(x) =$$

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

$$f(3) =$$



(b) (4 points) Is $f(x)$ continuous at $x = 3$? Use the definition of continuity to explain your answer.

4. The height of a projectile (in feet) is given by the function $h(t) = -16t^2 + 64t + 5$.

(a) (2 points) Is the projectile moving up or down at $t = 1$? *Show your work!*

(b) (4 points) What is the maximum height of the projectile? *Include units!*

5. (7 points) Suppose that y and x satisfy the implicit equation

$$2x + 2y + x^2y^3 = 2.$$

Find the the derivative $\frac{dy}{dx}$ at the point $(-2, 1)$.

6. (7 points) You are blowing air into a spherical balloon at a constant rate of $11 \text{ in}^3/\text{sec}$. How fast is the radius of the balloon growing when the balloon has a radius of 4 inches?