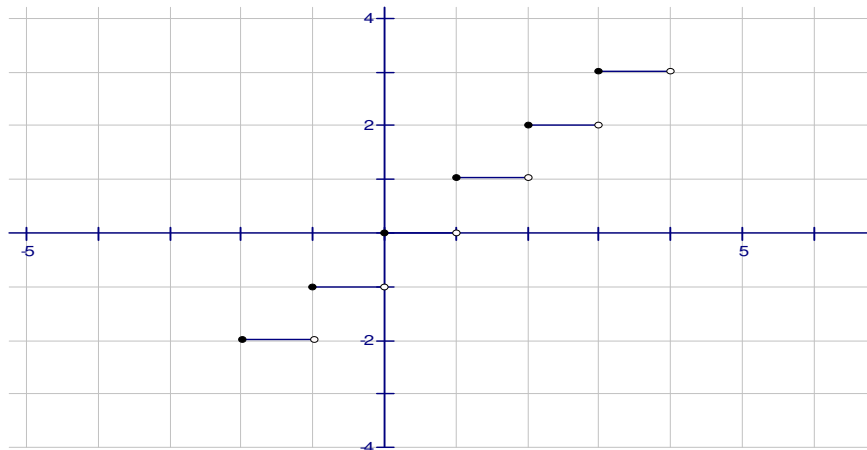


1. Use the graph of $f(x)$ shown below to find each limit, if it exists. If the limit does not exist, explain why.



a. $\lim_{x \rightarrow -1.1} f(x)$

b. $\lim_{x \rightarrow -1^-} f(x)$

c. $\lim_{x \rightarrow -1^+} f(x)$

d. $\lim_{x \rightarrow -1} f(x)$

2. Find the **FINITE** limit. If there is no finite limit, write DNE (does not exist).

a. $\lim_{x \rightarrow 0} \frac{\sin 5x}{x}$

b. $\lim_{x \rightarrow -1} \frac{x+1}{x^3+1}$

c. $\lim_{x \rightarrow 3} \frac{\sqrt{x+1} - 2}{x-3}$

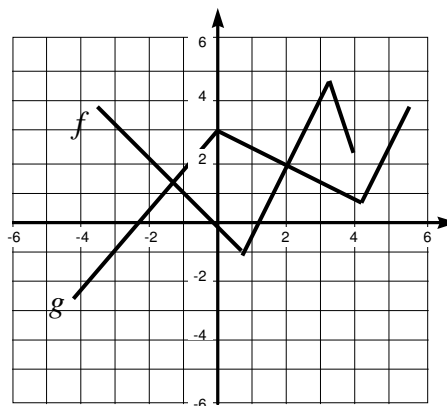
3. Find the limit.

a. $\lim_{x \rightarrow \infty} \frac{-2x^2 - 16}{5x^3 - 4}$

b. $\lim_{x \rightarrow 5^-} \frac{x-1}{x-5}$

c. $\lim_{x \rightarrow -\infty} \frac{x-16}{\sqrt{5x^2-4}}$

3. Use the graphs of f and g . Let $p(x) = f(g(x))$. Find $p'(-1)$.



4. Find any points of inflection and discuss the concavity of the graph of the function $f(x) = \sin 3x$ on the interval $[0, \pi)$.

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5. Find the derivative of the functions below. EXACT ANSWERS ONLY!!!

a. $f(x) = xe^{(1-x)^2}$

b. $y = \csc^2 4x$

c. $h(t) = \frac{2t^2 - 6t + 5}{3t + 1}$

$$d. f(x) = \ln \sqrt{x} + 8e^{\frac{1}{\sqrt{x}}}$$

$$e. y = x^{e^x}$$

6. Evaluate the following integrals. EXACT ANSWERS ONLY!!!

$$a. \int \theta \csc \theta^2 d\theta$$

$$b. \int_{-8}^8 |x^2 - 9| dx$$

$$c. \int \frac{x}{1-x} dx$$

$$d. \int \frac{e^x - e^{-x}}{e^x + e^{-x}} dx$$

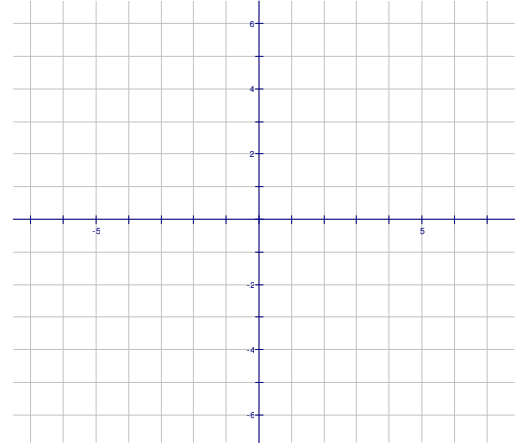
$$e. \int \frac{x^3 - 2x + 1}{x + 2} dx$$

7. Find a constant k such that the line is tangent to the graph of the function.

Function: $g(x) = k - x^2$ Line: $y = -x + 1$

8. Sketch the region bounded by the graphs of the algebraic functions and find the area of the region.

$$f(x) = -2x^2 + x + 1, \quad g(x) = x - 1$$



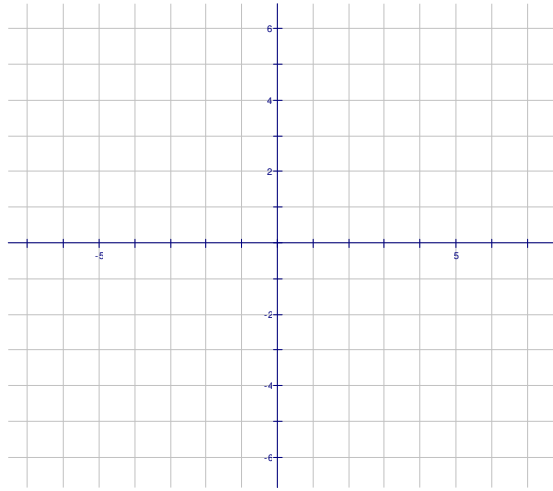
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9. A conical tank (with vertex down) is 10 feet across the top and 12 feet deep. If water is flowing into the tank at a rate of 10 cubic feet per minute, find the rate of change of the depth of the water when the water is 8 feet deep. Round to the nearest hundredth.

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10. Set up and evaluate the definite integral that gives the area of the region bounded by the graph of the function and the tangent line to the graph at the given point.

$$y = x^3 - 2x, \quad (-1, 1)$$

11. Consider the function $f(x) = x^3 - 9x$

a. Sketch the graph of the function



b. Determine the domain and range of the function. Use interval notation.

c. Locate all x and y -intercepts

For parts d-f you must use *CALCULUS!*

d. Find where the function is increasing/decreasing, and if it has any relative extrema.

e. Determine where the function is concave upwards/downwards, and whether it has any points of inflection.

f. Determine the absolute minimum or maximum of the function.

12. (8 points) The measurement of the side of a square is found to be 12 inches, with a possible error of $\frac{1}{64}$ inch. Use differentials to approximate the possible propagated error in computing the area of the square.

13. The graph below is the graph of the derivative f' of some unknown function f .

- Identify the interval(s) on which f is increasing.
- Identify the interval(s) on which f is decreasing.
- Estimate the value(s) of x at which f has a relative maximum or minimum.
- Identify the intervals on which f is concave upwards.
- Identify the intervals on which f is concave downwards.

