

On these pages, show all work needed to complete a problem.

(1-3) Evaluate the following limits exactly. (In at least two of these show how to arrive at the answer without a grapher or table.):

1.)
$$\lim_{x \rightarrow -\pi/2} \sec\left(\frac{\cos x + \pi \sin x}{3 \tan \frac{x}{2}}\right)$$

2.)
$$\lim_{t \rightarrow 0} \frac{t+t^2}{\sin 5t}$$

3.)
$$\lim_{\theta \rightarrow 0} \cot\left(\frac{\pi \sin \frac{\theta}{4}}{\theta}\right)$$

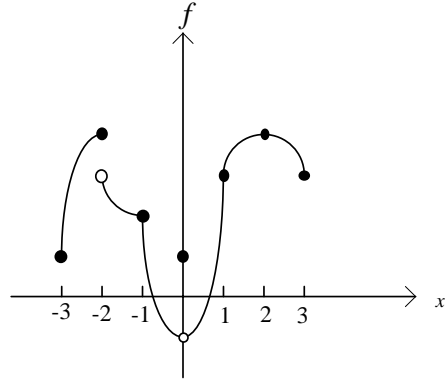
4.) Suppose $\frac{5}{x^2} < f(x) < \frac{5}{x}$ for all $x > 2$. Find $\lim_{x \rightarrow \infty} f(x)$. (State the reasoning behind your answer.)

5.) For the following function $f(x)$, at what points c in the domain:

(a.) does $\lim_{x \rightarrow c} f(x)$ **not** exist? _____

(b.) is the function **not** continuous? _____

(c.) is the function **not** differentiable? _____



6.) (a.) Use the definition of derivative to find $f'(x)$ if $f(x) = \frac{5}{3-x}$. You must show the setup and any work needed to get to your final answer. As always use proper notation in your work!

(b.) Find the equation of the line tangent to f at $x = 1$.

(7-9) Find $\frac{dy}{dx}$ for each of the following. (You do not need to simplify your answers.)

7.) $y = (\csc x + x \cos x) \tan x$ (You may use the formulas for the six basic trig functions.)

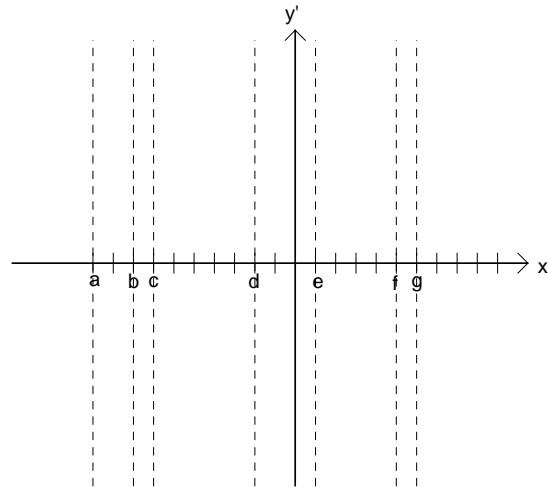
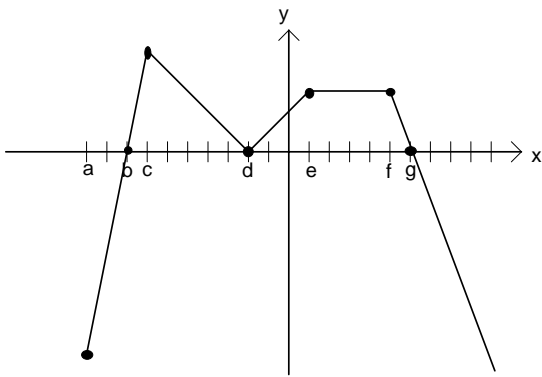
8.) $y = 7x^5 + 3x^4 - \frac{2}{x} + \frac{1}{x^3}$

9.) $y = \frac{5x^3 + 3x^2}{4x^2 + 2x + 1}$

10.) Suppose an object's position is given by $s(t) = 3t^2 + 2t + 1$ meters for $0 \leq t \leq 4$ where t is in seconds.

- (a.) What is the object's average velocity over the given interval?
- (b.) What is the object's velocity at $t = 1$?
- (c.) What is the object's acceleration at $t = 1$?

11.) Graph the derivative of the function at the left onto the graph at the right. Use the letters as guides to help you. Don't worry about the scale on the y-axis as long as things are correct relative to each other.



12.) Suppose u and v are functions of x that are differentiable at $x = 1$ and that $u(1) = 3$, $u'(1) = 2$, $v(1) = 5$, and $v'(1) = 7$. Find the values of the following derivatives at $x = 1$.

- (a.) $\frac{d}{dx}(uv)$
- (b.) $\frac{d}{dx}\left(\frac{u}{v}\right)$
- (c.) $\frac{d}{dx}(3u + 2v)$