1. Find $\lim_{x\to 0^-} \frac{1}{8+2^x}$.

a) ∞

b) $-\infty$

c) 1

d) $\frac{1}{8}$

e) $\frac{1}{9}$

2. Find $\lim_{x\to 0} \frac{x^3-x^2}{x^2(x+8)}$.

a) 0

b) $-\infty$

c) $-\frac{1}{8}$

d) ∞

e) $\frac{1}{8}$

3. Evaluate $\lim_{x\to 0} \frac{(8+x)^{-1}-8^{-1}}{x}$.

a) $-\frac{1}{64}$

b) $\frac{1}{8}$

c) $\frac{1}{64}$

d) ∞

e) $-\infty$

4. If $1 \le f(x) \le x^2+2x+2$ for all x, find $\lim_{x\to -1} f(x)$.

a) 2

b) 1

c) $-\frac{1}{2}$

d) -1

e) 0

5. Find a function $g(x)$ that agrees with $f(x) = \frac{6-\sqrt{x}}{36-x}$ for $x \neq 36$ and is continuous at $x = 36$.

a) $g(x) = \frac{1}{6+x}$

b) $g(x) = \frac{1}{6+\sqrt{x}}$

c) $g(x) = \frac{1}{36-x}$

d) $g(x) = \frac{1}{6-\sqrt{x}}$

e) $g(x) = 6+x$

6. Consider the slope of the given curve at each of the five points shown. List these five slopes in decreasing order.

a) Q, X, P, D, F

b) Q, P, X, F, D

c) D, F, P, Q, X

d) X, Q, P, F, D

e) F, D, P, X, Q

7. If the tangent line to $y = f(x)$ at $(1, 3)$ passes through the point $(5, 43)$, find $f'(1)$.

a) $f'(1) = 20$

b) $f'(1) = 11$

c) $f'(1) = -10$

d) $f'(1) = 10$

e) $f'(1) = -3$

8. Find the slope of the tangent line to the curve $y = \frac{\sqrt{x}}{x+6}$ at $\left(4, \frac{1}{5}\right)$.

a) $-\frac{1}{200}$

b) $\frac{1}{20}$

c) $\frac{1}{5}$

d) -4

e) $\frac{1}{200}$

9. The graph of a function $f(x)$ is given below. Use the graph to select the correct graph of $f'(x)$.

10. The position function of a particle is given by $s = t^3 - 3t^2 - 9t, t \geq 0$. When does the particle reach zero velocity?

a) $t = 3\,\text{sec}$

b) $t = 9\,\text{sec}$

c) $t = 4\,\text{sec}$

d) $t = 2\,\text{sec}$

e) $t = 6\,\text{sec}$

11. Differentiate $y = \dfrac{\tan x - 9}{\sec x}$.

a) $\dfrac{dy}{dx} = \cos x + \sin x$

b) $\dfrac{dy}{dx} = \cos x + 9 \sin x$

c) $\dfrac{dy}{dx} = \cos x - \sin x$

d) $\dfrac{dy}{dx} = 9 \cos x + \sin x$

e) $\dfrac{dy}{dx} = 9 \cos x - \sin x$

12. Find $\lim\limits_{\theta \to 0} \dfrac{\sin(\sin \theta)}{\sec \theta}$.

a) $\cos 1$

b) $\sin 1$

c) 0

d) 1

e) The limit does not exist.

13. Use implicit differentiation to find $\dfrac{dy}{dx}$ at the point $(2, 1)$ for $y^4 + x^2y^2 = y + 4$.

a) $-\dfrac{4}{11}$

b) 4

c) $\dfrac{1}{2}$

d) $-\dfrac{1}{2}$

e) $-\dfrac{11}{4}$

14. Find y'', if $y = \sqrt{2x + 7}$.

a) $y'' = -3(2x + 7)^{-\frac{3}{2}}$

b) $y'' = -\dfrac{3}{8}(2x + 7)^{-\frac{5}{2}}$

c) $y'' = -(2x + 7)^{-\frac{3}{2}}$

d) $y'' = (2x + 7)^{-\frac{1}{2}}$

e) $y'' = (2x + 7)^{\frac{3}{2}}$

15. Find the derivative of the function $f(x) = \sin(x^2) + \sin^2 x$.

a) $f'(x) = \cos(x^2) + \cos^2 x$

b) $f'(x) = \cos 2x + 2 \cos x$

c) $f'(x) = 2 \cos^2 x$

d) $f'(x) = 2 \cos x + \cos^2 x$

e) $f'(x) = 2x \cos(x^2) + 2 \sin x \cos x$

16. (5pts.) Find all the values of x where the function $f(x)$ is discontinuous from the left.

17. (6 pts.) Use the limit definition to find the derivative $f'(x)$ for $f(x) = \dfrac{1}{3 + x}$. (No credit will be given for any other methods.)

18. (7 pts.) Find $\dfrac{dy}{dx}$ at the point $\left(0, \dfrac{1}{2}\right)$ where $x^2 + y^2 = (2x^2 + 2y^2 - x)^2$.

19. (7 pts.) If $f(x) = \sec x$, find $f'''\left(\dfrac{\pi}{4}\right)$.