

$$1) \lim_{x \rightarrow 3} \frac{27 - x^3}{x - 3} = -27$$

$$10) \frac{d}{dx} \left(\frac{3x + x^4}{x^2} \right) = -\frac{3}{x^2} + 2x$$

$$2) \lim_{x \rightarrow 0} \frac{(\sqrt{x+9} - 3)}{x} = \frac{1}{6}$$

$$11) \frac{d}{dx} (3x^2 \tan(2x)) = 6x \tan(2x) + 6x^2 \sec^2(2x)$$

$$3) \lim_{x \rightarrow 0} \frac{\sin(6x)}{4x} = \frac{3}{2}$$

$$12) \frac{d}{dx} (\cos^2(\pi x^3 + 4)) \\ = -6 \cos(\pi x^3 + 4) \sin(\pi x^3 + 4) \pi x^2$$

$$4) \lim_{x \rightarrow \infty} \frac{x + 2x^2}{4x + 3} = \infty$$

$$13) \int x \sqrt{4x^2 - 1} dx = \frac{1}{12} (4x^2 - 1)^{3/2} + c$$

$$5) \lim_{x \rightarrow 6} \frac{\sqrt{3x+7}}{x-4} = \frac{5}{2}$$

$$14) \int x \sqrt{x-1} dx = \frac{2}{5}(x-1)^{\frac{5}{2}} + \frac{2}{3}(x-1)^{\frac{3}{2}} + c$$

$$6) \lim_{x \rightarrow 1} \frac{\left(\frac{1}{x+1} - \frac{1}{2} \right)}{x-1} = -\frac{1}{4}$$

$$15) \int_1^3 \frac{x^2 - 5x + 6}{x-2} dx = -2$$

$$7) \frac{d}{dt} (3(t^3 + 2t)^4) = 12(t^3 + 2t)^3 (3t^2 + 2)$$

$$16) \int 5 \sec^2(2x) \tan^2(2x) dx = \frac{5}{6} \tan^3(2x) + c$$

$$8) \frac{d}{dx} (\csc(2x)) = -2 \csc(2x) \cot(2x)$$

$$17) \int \csc^2(2x) dx = -\frac{1}{2} \cot(2x) + C$$

$$9) \frac{d}{dx} \left(3x^2 - \frac{1}{\sqrt{x}} + 5 \right) = 6x + \frac{1}{2x^{3/2}}$$

$$18) \int_0^{\frac{\pi}{4}} x^2 \cos(x^3) dx = \frac{1}{3} \sin\left(\frac{1}{64}\pi^3\right)$$

$$19) \frac{dy}{dx} = -\frac{1}{3} \frac{7x + 3y}{x + 3y}$$

$$20) \lim_{x \rightarrow 3^+} f(x) = \lim_{x \rightarrow 3^-} f(x) = 8$$

which means: $\lim_{x \rightarrow 3} f(x) = 8$ but, $f(3) = 9$

so, $f(x)$ is discontinuous at $x = 3$.

Since $\lim_{x \rightarrow 3^+} f(x) = \lim_{x \rightarrow 3^-} f(x)$,

the discontinuity is removable.

$$21) \text{For the proof, choose } \delta = \frac{\epsilon}{2}.$$

$$22) f'(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x} = 6x - 4$$

$$23) \int_2^5 (3x + 1) dx = n \lim_{\infty} \sum_{i=1}^n f(c_i) \Delta x = \frac{69}{2}$$

$$\text{where: } \Delta x = \frac{3}{n} \quad \text{and} \quad c_i = 2 + \frac{3}{n}i$$

$$24) \text{a) } x^2 + y^2 = 13^2 \\ \frac{dy}{dt} = -12 \text{ ft/sec.}$$

$$\text{b) } \cos(\theta) = \frac{x}{13} \\ \frac{d\theta}{dt} = -1 \text{ rad/sec}$$

$$25) A = (144y - 2y^2) \\ \text{max. area when } y = 36 \text{ ft. and } x = 72 \text{ ft.} \\ \text{max. area} = 2592 \text{ sq.ft.}$$

$$26) \text{washer} = \pi \int_0^8 ((6 - \sqrt{2x})^2 - 2^2) dx = 64\pi$$

$$\text{shell} = 2\pi \int_0^4 ((6 - y) \left(\frac{y^2}{2} \right)) dy = 64\pi$$

$$27) 2\pi \int_0^3 x \sqrt{1 + (-2x)^2} dx = 117.32$$