1. (a)

$$\frac{d}{dx}5^x + \log_3 x$$
$$\frac{d}{dx}5^x + \frac{d}{dx}\log_3 x$$
$$5^x \ln(5) + \frac{1}{x\ln(3)}$$

(b)

$$\frac{d}{dx}\arctan(x^2+1)$$
$$\frac{2x}{1+(x^2+1)^2}$$

(c)

$$\frac{d}{dx}\arcsin(e^x)$$
$$\frac{1}{\sqrt{1-e^{2x}}}e^x$$
$$\frac{e^x}{\sqrt{1-e^{2x}}}$$

2.

$$\lim_{x\to 0}\frac{\sin(3x)}{x} = \frac{0}{0}$$
$$\lim_{x\to 0}\frac{3\cos 3x}{1}$$
$$\lim_{x\to 0} 3\cos 3x = 3$$

3.

4.

$$L(x) = f(0) + f'(0)(x-0)$$
$$L(x) = \sin(0) + \cos(0)x$$
$$L(x) = x$$

5.

$$\frac{d}{dx}\tan(\sqrt{x})$$
$$\sec^2(\sqrt{x})\frac{1}{2}x^{\frac{1}{2}-1}$$
$$\sec^2(\sqrt{x})\frac{1}{2}x^{-\frac{1}{2}}$$
$$\frac{\sec^2(\sqrt{x})}{2\sqrt{x}}$$

6.

$$y = \frac{2}{4} = \frac{1}{2}$$
$$y' = f'(x+\Delta x) = \frac{2}{4+0.2} = \frac{2}{4.2} = \frac{1}{2.1}$$
$$\Delta y = \frac{1}{2.1} - \frac{1}{2} = \frac{10}{21} - \frac{1}{2} = \frac{20-21}{42} = -\frac{1}{42}$$
$$dy = f'(x)dx$$
$$dy = \frac{-2}{x^2} \times 0.2$$
$$dy = \frac{-2}{4^2} \times 0.2 = -\frac{0.4}{16} = -\frac{0.1}{4} = -\frac{1}{40}$$

7.

$r_1 = 12 + 0.06 = 12.06$
$r_2 = 12 - 0.06 = 11.94$

$V(r_1) = \frac{4}{3}\pi \times 12.06^3$
$V(r_2) = \frac{4}{3}\pi \times 11.94^3$

$V(r_1) - V(r_2) = \frac{4}{3}\pi(12.06^3 - 11.94^3)$
$V(r_1) - V(r_2) = \frac{4}{3}\pi(12.06 - 11.94)(12.06^2 + 12.06 \times 11.94 + 11.94^2)$
$V(r_1) - V(r_2) = \frac{4}{3}\pi \times 0.12((12 + 0.06)^2 + 12.06 \times 11.94 + (12 - 0.06)^2)$
$V(r_1) - V(r_2) = \frac{4}{3}\pi \times 0.12((12 + 0.06)^2 + (12 + 0.06)(12 - 0.06) + (12 - 0.06)^2)$
$V(r_1) - V(r_2) = \frac{4}{3}\pi \times 0.12((12 + 0.06)^2 + 12^2 - 0.06^2 + (12 - 0.06)^2)$

8.

$\frac{d}{dx} 2e^{x^2-4x}$
$2\frac{d}{dx} e^{x^2-4x}$
$2e^{x^2-4x}(2x - 4)$
$e^{x^2-4x}(4x - 8)$
$e^{x^2-4x}(4x - 8) = 0$
$4x - 8 = 0 \implies x = 2$

9.

10.

11.

12.

13.

14.

15.

16.

17.

18.

19.

$$y = 20\cosh\left(\frac{0}{20}\right) - 15 = 20\cosh(0) - 15 = 5$$

$$\frac{d}{dx}\cosh\left(\frac{x}{20}\right) = senh\left(\frac{x}{20}\right)\frac{1}{20}$$

$$\frac{senh\left(\frac{7}{20}\right)}{20} \approx \frac{.36}{20} = .018$$