

pg. 247 #8, 15, 17, 19, 21, 23, 25

$$8. (1+x)^k \approx 1+kx$$

$$a. (1.002)^{100} \approx 1 + 100 \cdot 0.002 = 1.2$$

$$\begin{aligned} \text{Accuracy} &= |\text{Actual} - \text{Approximate}| \\ &= 0.0216 \end{aligned}$$

$$b. \sqrt[3]{1.009} \approx 1 + \frac{1}{3} \cdot 0.009 = 1.003$$

$$\text{Accuracy} = 0.000008955$$

$$15. y = x^3 - 3x$$

$$\frac{dy}{dx} = 3x^2 - 3$$

$$dy = (3x^2 - 3) \cdot dx$$

$$\text{at } x = 2, dx = 0.05$$

$$\begin{aligned} dy &= (3 \cdot 2^2 - 3) \cdot 0.05 \\ &= 0.45 \end{aligned}$$

$$17. y = x^2 \ln x$$

$$\frac{dy}{dx} = x^2 \cdot \frac{1}{x} + \ln x \cdot 2x$$

$$= x + 2x \ln x$$

$$dy = (x + 2x \ln x) dx$$

$$\text{at } x=1, dx = 0.01$$

$$dy = (1 + 2 \ln 1) \cdot 0.01$$

$$= 0.01$$

19.  $y = e^{\sin x}$

$$\frac{dy}{dx} = e^{\sin x} \cdot \cos x$$

$$dy = (\cos x \cdot e^{\sin x}) dx$$

$$\text{at } x = \pi, dx = -0.1$$

$$dy = (\cos \pi \cdot e^{\sin \pi}) \cdot -0.1$$

$$= -1 \cdot 1 \cdot -0.1$$

$$= 0.1$$

21.  $y + xy - x = 0$

$$\frac{dy}{dx} + x \cdot \frac{dy}{dx} + y \cdot \frac{dx}{dx} - 1 \frac{dx}{dx} = 0$$

$$\frac{dy}{dx} (1+x) = 1-y$$

$$\frac{dy}{dx} = \frac{1-y}{1+x}$$

$$dy = (1-y) \cdot dx$$

$$dy = \left( \frac{1-y}{1+x} \right) \cdot dx$$

$$\text{at } x=0, dx = 0.01$$

↳ implies  $y=0$  by substituting into original equation

$$\begin{aligned} dy &= \left( \frac{1-0}{1+0} \right) \cdot 0.01 \\ &= 0.01 \end{aligned}$$

23.  $d(\sqrt{1-x^2})$  \* SAME AS FINDING DY!

$$\text{let } y = \sqrt{1-x^2}$$

$$\frac{dy}{dx} = \frac{1}{2} (1-x^2)^{-1/2} \cdot -2x$$

$$= -x(1-x^2)^{-1/2}$$

$$dy = \left( \frac{-x}{\sqrt{1-x^2}} \right) dx$$

25.  $d(\arctan 4x)$

$$\text{let } y = \arctan 4x$$

$$\frac{dy}{dx} = \frac{1}{1+16x^2} \cdot 4$$

$$dy = \frac{4 dx}{1+16x^2}$$