Calculus Name_____ ID: 1

Linearization Practice

Date_____ Period____

For each problem, find a linear approximation of the given quantity.

1) 2.01^3

2) 1.96^3

3) 4.01^3

4) sin 29°

5) cos 92°

6) 1.98^3

7) cos 137°

8) 7.02^3

9) $\sqrt[3]{26.8}$

10) $\sqrt{25.2}$

11) cos 62°

12) sin 148°

Use differentials to solve each problem.

13) The radius of a sphere is measured to be 9 in, with a possible error of $\pm\frac{3}{10}$ in. Estimate the possible propagated error in the calculated volume.

14) The sides of a square are measured to be 8 ft, with a possible error of $\pm\frac{1}{5}$ ft. Estimate the possible propagated error in the calculated area.

15) The sides of a cube are measured to be 4 ft, with a possible error of $\pm\frac{3}{10}$ ft. Estimate the possible propagated error in the calculated volume.

16) The radius of a circle is measured to be 4 cm, with a possible error of $\pm\frac{1}{5}$ cm. Estimate the possible propagated error in the calculated area.

17) The radius of a sphere is measured to be 4 ft, with a possible error of $\pm\frac{1}{5}$ ft. Estimate the possible propagated error in the calculated surface area.

18) The radius of a sphere is measured to be 9 ft, with a possible error of $\pm\frac{1}{10}$ ft. Estimate the possible propagated error in the calculated volume.

19) The radius of a sphere is measured to be 5 in, with a possible error of $\pm\frac{1}{5}$ in. Estimate the possible propagated error in the calculated volume.

20) The radius of a sphere is measured to be 5 cm, with a possible error of $\pm\frac{3}{10}$ cm. Estimate the possible propagated error in the calculated surface area.

21) The radius of a circle is measured to be 4 ft, with a possible error of $\pm\frac{3}{10}$ ft. Estimate the possible propagated error in the calculated area.

22) The radius of a sphere is measured to be 9 ft, with a possible error of $\pm\frac{1}{5}$ ft. Estimate the possible propagated error in the calculated surface area.

Answers to Linearization Practice (ID: 1)

1) $f(x) = x^3$, $f'(x) = 3x^2$
$x_0 = 2$, $\Delta x = 0.01$

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{203}{25} = 8.12$

2) $f(x) = x^3$, $f'(x) = 3x^2$
$x_0 = 2$, $\Delta x = -0.04$

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{188}{25} = 7.52$

3) $f(x) = x^3$, $f'(x) = 3x^2$
$x_0 = 4$, $\Delta x = 0.01$

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{1612}{25} = 64.48$

4) $f(x) = \sin x$, $f'(x) = \cos x$
$x_0 = \frac{\pi}{6}$ radians, $\Delta x = -\frac{\pi}{180}$ radians

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{180 - \pi\sqrt{3}}{360} \approx 0.4849$

5) $f(x) = \cos x$, $f'(x) = -\sin x$
$x_0 = \frac{\pi}{2}$ radians, $\Delta x = \frac{\pi}{90}$ radians

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = -\frac{\pi}{90} \approx -0.0349$

6) $f(x) = x^3$, $f'(x) = 3x^2$
$x_0 = 2$, $\Delta x = -0.02$

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{194}{25} = 7.76$

7) $f(x) = \cos x$, $f'(x) = -\sin x$
$x_0 = \frac{3\pi}{4}$ radians, $\Delta x = \frac{\pi}{90}$ radians

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{\sqrt{2}(-90 - \pi)}{180} \approx -0.7318$

8) $f(x) = x^3$, $f'(x) = 3x^2$
$x_0 = 7$, $\Delta x = 0.02$

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{17297}{50} = 345.94$

9) $f(x) = \sqrt[3]{x}$, $f'(x) = \frac{1}{3x^{\frac{2}{3}}}$
$x_0 = 27$, $\Delta x = -0.2$

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{404}{135} \approx 2.9926$

10) $f(x) = \sqrt{x}$, $f'(x) = \frac{1}{2x^{\frac{1}{2}}}$
$x_0 = 25$, $\Delta x = 0.2$

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{251}{50} = 5.02$

11) $f(x) = \cos x$, $f'(x) = -\sin x$
$x_0 = \frac{\pi}{3}$ radians, $\Delta x = \frac{\pi}{90}$ radians

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{90 - \pi\sqrt{3}}{180} \approx 0.4698$

12) $f(x) = \sin x$, $f'(x) = \cos x$

$x_0 = \frac{5\pi}{6}$ radians, $\Delta x = -\frac{\pi}{90}$ radians

$f(x_0 + \Delta x) \approx f(x_0) + f'(x_0)\Delta x = \frac{90 + \pi\sqrt{3}}{180} \approx 0.5302$

13) $V = \frac{4}{3}\pi r^3$, $dV = 4\pi r^2\, dr$

$r = 9$, $dr = \pm 0.3$

$\Delta V \approx dV = \pm\frac{486\pi}{5} \approx \pm 305.3628$ in³

14) $A = s^2$, $dA = 2s\, ds$

$s = 8$, $ds = \pm 0.2$

$\Delta A \approx dA = \pm\frac{16}{5} = \pm 3.2$ ft²

15) $V = s^3$, $dV = 3s^2\, ds$

$s = 4$, $ds = \pm 0.3$

$\Delta V \approx dV = \pm\frac{72}{5} = \pm 14.4$ ft³

16) $A = \pi r^2$, $dA = 2\pi r\, dr$

$r = 4$, $dr = \pm 0.2$

$\Delta A \approx dA = \pm\frac{8\pi}{5} \approx \pm 5.0265$ cm²

17) $A = 4\pi r^2$, $dA = 8\pi r\, dr$

$r = 4$, $dr = \pm 0.2$

$\Delta A \approx dA = \pm\frac{32\pi}{5} \approx \pm 20.1062$ ft²

18) $V = \frac{4}{3}\pi r^3$, $dV = 4\pi r^2\, dr$

$r = 9$, $dr = \pm 0.1$

$\Delta V \approx dV = \pm\frac{162\pi}{5} \approx \pm 101.7876$ ft³

19) $V = \frac{4}{3}\pi r^3$, $dV = 4\pi r^2\, dr$

$r = 5$, $dr = \pm 0.2$

$\Delta V \approx dV = \pm 20\pi \approx \pm 62.8319$ in³

20) $A = 4\pi r^2$, $dA = 8\pi r\, dr$

$r = 5$, $dr = \pm 0.3$

$\Delta A \approx dA = \pm 12\pi \approx \pm 37.6991$ cm²

21) $A = \pi r^2$, $dA = 2\pi r\, dr$

$r = 4$, $dr = \pm 0.3$

$\Delta A \approx dA = \pm\frac{12\pi}{5} \approx \pm 7.5398$ ft²

22) $A = 4\pi r^2$, $dA = 8\pi r\, dr$

$r = 9$, $dr = \pm 0.2$

$\Delta A \approx dA = \pm\frac{72\pi}{5} \approx \pm 45.2389$ ft²