(5) $y = x^5 + x$

$dy = (5x^4 + 1)\,dx$

(9) $s = 2(3t^2 - 5)^4$

$ds = 8(3t^2 - 5)^3 (6t)\,dt$

$= 48t\,(3t^2 - 5)^3\,dt$

(13) $y = x^2 (1-x)^3$

$dy = \left[x^2 \cdot 3(1-x)^2(-1) + (1-x)^3 2x\right] dx$

$= (1-x)^2 \left[-3x^2 + (1-x)2x\right] dx$

$= (1-x)^2 \left[-3x^2 + 2x - 2x^2\right] dx$

$= (1-x)^2 (2x - 5x^2)\,dx$

$= x(1-x)^2 (2 - 5x)\,dx$

(17) $y = 7x^2 + 4x$, $x = 4$, $\Delta x = 0.2$
Note: $dx = \Delta x = 0.2$

$$\Delta y = f(x+\Delta x) - f(x)$$
$$= f(4.2) - f(4)$$
$$= 140.28 - 128$$
$$= 12.28$$

$$dy = (14x + 4)\,dx$$
$$= (60)(0.2)$$
$$= 12$$

(21) $f(x) = x^2 + 2x$ $\quad a = 0$
$f'(x) = 2x + 2$

$f(0) = 0$
$f'(0) = 2$

$$f(x) \approx f(a) + f'(a)(x-a)$$
$$\approx f(0) + f'(0)(x-0)$$
$$\approx 0 + 2x$$
$$\approx 2x$$

(25) Want the change in circle's circumference, given $dr = 250$ km.

$$C = 2\pi r$$
$$dC = 2\pi\, dr$$
$$= 2\pi(250)$$
$$\approx 1570 \text{ km}$$

(27) Given : $r = 40.6$ cm

$dr = 0.05$ cm

$A = \pi r^2$

Find $\frac{dA}{A}$.

$$dA = 2\pi r\, dr$$
$$\frac{dA}{A} = \frac{2\pi r\, dr}{\pi r^2}$$
$$= \frac{2 dr}{r}$$
$$= \frac{2(0.05)}{40.6}$$
$$\approx 0.00246$$

or 0.246%

(33) Given: $\frac{dr}{r} = 2\%$

$A = \pi r^2$

Find $\frac{dA}{A}$.

$$dA = 2\pi r\, dr$$

$$\frac{dA}{A} = \frac{2\pi r\, dr}{\pi r^2}$$

$$= \frac{2dr}{r}$$

$$= 2\left(\frac{dr}{r}\right)$$

$$= 4\%$$

35) First find the linearization of
$f(x) = \sqrt{x}$ at $a = 4$.
We choose $a = 4$ because it's close to 4.05
and $\sqrt{4}$ is exact.

$$f(x) = x^{1/2}$$
$$f'(x) = \frac{1}{2} x^{-1/2}$$
$$a = 4$$
$$f(4) = 2$$
$$f'(4) = \frac{1}{2}\left(\frac{1}{2}\right) = \frac{1}{4}$$

$$f(x) \approx f(a) + f'(a)(x-a)$$
$$\approx f(4) + f'(4)(x-4)$$
$$\sqrt{x} \approx 2 + \frac{1}{4}(x-4)$$

Now sub $x = 4.05$:

$$\sqrt{4.05} \approx 2 + \frac{1}{4}(4.05-4)$$
$$\approx 2.0125$$