SECTION 3.3

1. (a) TRUE

(b) FALSE $f'(x) = 6x^5$

(c) FALSE

2. (a) $f(x) = 10$
$f'(x) = 0$

(b) $f(x) = x^{-3}$
$f'(x) = -3x^{-4}$

3. (a) $f(x) = 5x^4$
$f'(x) = 20x^3$

(b) $f(x) = x^4 + 4x^3$
$f'(x) = 4x^3 + 12x^2$

(c) $f(x) = 7x^3 + 6x^2 + 10x + 12$
$f'(x) = 21x^2 + 12x + 10$

(d) $f(x) = x^{-7} - x^{-6}$
$f'(x) = -7x^{-8} + 6x^{-7}$

(e) $f(x) = x^{\pi}$
$f'(x) = \pi x^{\pi - 1}$

(f) $f(x) = 3x^3 - 6x^{-2}$
$f'(x) = 9x^2 + 12x^{-3}$

(g) $f(x) = (x+1)^2 = (x+1)(x+1) = x^2 + 2x + 1$
$f'(x) = 2x + 2$

4. $f(t) = t^2 + \frac{1}{t} = t^2 + t^{-1}$

$v(t) = f'(t) = 2t - t^{-2}$

$v(2) = 2(2) - (2)^{-2} = 4 - \frac{1}{4} = 3.75 \text{ ft/sec}$

5. $f(x) = mx + b$

$f'(x) = m$

every tangent line has a slope of m

6. ⓐ $f(x) = 5x^4(x+1) = 5x^5 + 5x^4$

$f'(x) = 25x^4 + 20x^3$

ⓑ $f(x) = (x^2+x)(3x+1) = 3x^3 + 4x^2 + x$

$f'(x) = 9x^2 + 8x + 1$

ⓒ $f(x) = \dfrac{x^3}{x^2+10}$ QR

$$f'(x) = \frac{(x^2+10)\cdot 3x^2 - x^3(2x)}{(x^2+10)^2}$$

$$= \frac{3x^4 + 30x^2 - 2x^4}{(x^2+10)^2}$$

$$= \frac{x^2(x^2+30)}{(x^2+10)^2}$$

(d) $f(x) = \dfrac{1+x^{-1}}{2-x^{-2}}$ QR

$$f'(x) = \frac{(2-x^{-2})(0-x^{-2}) - (1+x^{-1})(0+2x^{-3})}{(2-x^{-2})^2}$$

$$= \frac{-2x^{-2} + x^{-4} - 2x^{-3} - 2x^{-4}}{(2-x^{-2})^2}$$

$$= \frac{-2x^{-2} - 2x^{-3} - x^{-4}}{(2-x^{-2})^2}$$

$$= \frac{x^{-4}[-2x^{2} - 2x - 1]}{(2-x^{-2})^2}$$

(e) $f(x) = \dfrac{\sqrt{x}-1}{\sqrt{x}+1} = \dfrac{x^{\frac{1}{2}}-1}{x^{\frac{1}{2}}+1}$ QR

$$f'(x) = \frac{(x^{\frac{1}{2}}+1)(\frac{1}{2}x^{-\frac{1}{2}}) - (x^{\frac{1}{2}}-1)(\frac{1}{2}x^{-\frac{1}{2}})}{(x^{\frac{1}{2}}+1)^2}$$

$$= \frac{\frac{1}{2} + \frac{1}{2}x^{-\frac{1}{2}} - \frac{1}{2} + \frac{1}{2}x^{-\frac{1}{2}}}{(x^{\frac{1}{2}}+1)^2}$$

$$= \frac{x^{-\frac{1}{2}}}{(x^{\frac{1}{2}}+1)^2}$$

7. $f(x) = \dfrac{1}{x^2} = x^{-2}$

(a) $f'(x) = -2x^{-3}$

(b) QR $f'(x) = \dfrac{x^2(0) - 1(2x)}{(x^2)^2} = \dfrac{-2x}{x^4} = -2x^{-3}$

8 $f(x) = 4x^3$

$f'(x) = 4(3x^2) + x^3(0) = 12x^2$

SECTION 3.4

SKIP #1-3

4. ⓐ $y = \sin(x) - \cos(x)$

$y' = \cos(x) - [-\sin(x)] = \cos(x) + \sin(x)$

ⓑ $y = \dfrac{\tan(x)}{x+1}$ QR

$y' = \dfrac{(x+1)\sec^2(x) - \tan(x) \cdot 1}{(x+1)^2}$

$= \dfrac{x\sec^2(x) + \sec^2(x) - \tan(x)}{(x+1)^2}$

ⓒ $y = \sin\left(\frac{\pi}{4}\right)$

$y' = 0$

ⓓ $y = x^3 \sin(x)$ PR

$y' = x^3 \cdot \cos(x) + \sin(x) \cdot 3x^2$

$= x^3\cos(x) + 3x^2\sin(x)$

ⓔ $y = x^2 + 2x\cos(x)$

$y' = 2x + 2[x(-\sin(x)) + \cos(x) \cdot 1]$

$= 2x - 2x\sin(x) + 2\cos(x)$

$= 2[x - 2\sin(x) + \cos(x)]$

(f) $y = \dfrac{x}{\sec(x)+1}$ QR

$$y' = \frac{[\sec(x)+1]\cdot 1 - x[\sec(x)\tan(x)+0]}{[\sec(x)+1]^2}$$
$$= \frac{\sec(x)+1 - x\sec(x)\tan(x)}{[\sec(x)+1]^2}$$

(g) $y = \dfrac{x}{\cot(x)}$ QR

$$y' = \frac{\cot(x)\cdot 1 - x[-\csc^2(x)]}{\cot^2(x)}$$
$$= \frac{\cot(x) + x\csc^2(x)}{\cot^2(x)}$$

5. $f(x) = \sqrt{3}\sin(x) + 3\cos(x)$

want to find where $f'(x) = 0$

$f'(x) = \sqrt{3}\cos(x) - 3\sin(x)$

$$\sqrt{3}\cos(x) - 3\sin(x) = 0$$
$$\frac{\sqrt{3}\cos(x)}{\cos(x)} = \frac{3\sin(x)}{\cos(x)}$$
$$\frac{\sqrt{3}}{3} = \frac{3\tan(x)}{3}$$
$$\tan(x) = \frac{\sqrt{3}}{3}$$

$$x = \frac{\pi}{6} + n\pi$$

n is an integer