p. 215

9.) $f'(x) = (2\cos(3x+1)) \cdot 3 = 6\cos(3x+1)$

22.) $f'(x) = -5(-\sin(2-x^3))(-3x^2) = -15x^2\sin(2-x^3)$

38.) $f'(x) = \tan x(\frac{d}{dx}\cot x) + (\frac{d}{dx}\tan x)\cot x = \tan x(-\csc^2 x) + (\sec^2 x)\cot x$
$= \frac{\sin x}{\cos x}(-\frac{1}{\sin^2 x}) + (\frac{1}{\cos^2 x})\frac{\cos x}{\sin x}$
$= -\frac{1}{\cos x \sin x} + \frac{1}{\cos x \sin x}$
$= 0$

Alternatively, one could say that

$$f(x) = \tan x \cot x = \tan x(\frac{1}{\tan x}) = 1$$

So

$$f'(x) = \frac{d}{dx}1 = 0$$

32.) $g'(t) = \frac{\cos(5t)(\frac{d}{dt}\sin(3t)) - \sin(3t)(\frac{d}{dt}\cos(5t))}{\cos^2(5t)}$
$= \frac{\cos(5t)(3\cos(3t)) - \sin(3t)(-5\sin(5t))}{\cos^2(5t)}$
$= \frac{3\cos(5t)\cos(3t) + 5\sin(3t)\sin(5t)}{\cos^2(5t)}$

59.) A horizontal tangent has slope zero. So we find when $y' = 0$.

$$y' = (\cos(\frac{\pi}{3}x))(\frac{\pi}{3}) = 0$$

Dividing both sides by $\frac{\pi}{3}$:

$$\cos(\frac{\pi}{3}x) = 0$$

So

$$\frac{\pi}{3}x = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \frac{7\pi}{2}, ...$$

Multiplying both sides by $\frac{3}{\pi}$ gives

$$x = \frac{3}{2}, \frac{9}{2}, \frac{15}{2}, \frac{21}{2}, ...$$

which is to say

$$x = \frac{3+6k}{2}$$

for any integer k. Next, we find the y-coordinate for the x's we found:

$$y = \sin(\frac{\pi}{3}\frac{3+6k}{2}) = \sin(\pi\frac{1+2k}{2})$$

$$= \begin{cases} \sin(\frac{\pi}{2}) & \text{if } k \text{ is even} \\ \sin(\frac{3\pi}{2} & \text{if } k \text{ is odd} \end{cases}$$

$$= \begin{cases} 1 & \text{if } k \text{ is even} \\ -1 & \text{if } k \text{ is odd} \end{cases}$$

So the points are

$$(x, y) = \begin{cases} (\frac{3+6k}{2}, 1) & \text{if } k \text{ is even} \\ (\frac{3+6k}{2}, -1) & \text{if } k \text{ is odd} \end{cases}$$

p. 245

1.) $f(x) = -3x^4 + 2x^{-\frac{1}{2}} + 1$

$f'(x) = -3(4x^3) + 2(-\frac{1}{2})x^{-\frac{3}{2}} = -3x^4 - x^{-\frac{3}{2}}$

2.) $g(x) = (x^3 + 4)^{-\frac{1}{2}}$

$g'(x) = (-\frac{1}{2})(x^3 + 4)^{-\frac{3}{2}}(3x^2) = -\frac{3}{2}(x^3 + 4)^{-\frac{3}{2}}$

6.) $g'(s) = \frac{\cos(3x)(\frac{d}{ds}\sin(3s+1)) - \sin(3s+1)(\frac{d}{ds}\cos(3s))}{\cos^2(3s)}$

$= \frac{\cos(3x)((\cos(3s+1))(3)) - \sin(3s+1)((-\sin(3s))(3))}{\cos^2(3s)}$

$= \frac{3\cos(3x)\cos(3s+1) + 3\sin(3s+1)\sin(3s)}{\cos^2(3s)}$

10.) $g(x) = \tan(x^2 + 1)$

$g'(x) = (\sec^2(x^2 + 1))(2x) = 2x\sec^2(x^2 + 1)$

$g''(x) = 2x(\frac{d}{dx}\sec^2(x^2 + 1)) + (\frac{d}{dx}2x)sec^2(x^2 + 1)$

$= 2x(2\sec(x^2 + 1)\sec(x^2 + 1)\tan(x^2 + 1)2x) + (2)sec^2(x^2 + 1)$

$= 8x^2\sec(x^2 + 1)\sec(x^2 + 1)\tan(x^2 + 1) + 2sec^2(x^2 + 1)$

31.) $p(x) = ax^2 + bx + c$

$p'(x) = 2ax + b$

$p''(x) = 2a$

Going from last line to first

$$p''(0) = 2a = 4 \text{ means } a = 2$$

So

$$p'(x) = 2(2)x + b = 4x + b$$

Then

$$p'(1) = 4(1) + b = 8 \text{ means } b = 4$$

So

$$p(x) = 2x^2 + 4x + c$$

Finally

$$p(-1) = 2(-1)^2 + 4(-1) + c = 6$$
$$2 - 4 + c = 6$$
$$c = 8$$

Thus

$$p(x) = 2x^2 + 4x + 8$$