section 3.4 pg 138 # 1, 9, 19, 33, 39, 63, 65

① $f(x) = 4\sqrt{x^5} + \frac{2}{\sqrt{x}} = 4x^{5/2} + 2x^{-1/2}$

$f'(x) = 4 \cdot \frac{5}{2} x^{3/2} + 2\left(\frac{-1}{2}\right) x^{-3/2} = 10x^{3/2} - x^{-3/2} = 10\sqrt{x^3} - \frac{1}{\sqrt{x^3}}$

⑨ $f(x) = (3 - 2x^2)^{-3/2}$

$f'(x) = -\frac{3}{2}(3 - 2x^2)^{-5/2}(-4x) = 6x(3 - 2x^2)^{-5/2}$

⑲ $g(x) = \frac{1}{(x - 2x^3)^{4/3}} = (x - 2x^3)^{-4/3}$

$g'(x) = -\frac{4}{3}(x - 2x^3)^{-4/3}(1 - 6x^2)$

㉝ $f(x) = (1 - x^2)(2x + 4)^{1/3}$

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

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

㊴ $f(x) = \frac{(2x+1)^{1/2}}{(3x+4)^{1/3}}$

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

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

$= (2x+1)^{-1/2}(3x+4)^{-1/3} - (2x+1)^{1/2}(3x+4)^{-4/3}$

(63) $P = 2\pi\sqrt{L/g}$ $\qquad g = 32\ ft/s^2$

$$\frac{dP}{dL} = 2\pi\left(\tfrac{1}{2}\right)\left(L/g\right)^{-1/2}\cdot\frac{1}{g} = \frac{\pi}{g}\left(\frac{L}{g}\right)^{-1/2}$$

we have $P=2$, but $\frac{dP}{dL}$ has L in it. use equation to find L

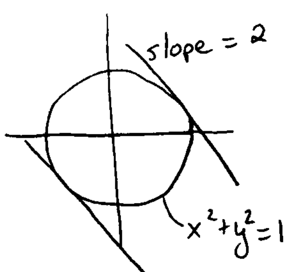
$$2 = 2\pi\sqrt{L/g} \qquad \frac{1}{\pi} = \sqrt{L/g} \qquad \frac{1}{\pi^2} = \frac{L}{g} \qquad L = \frac{g}{\pi^2} = \frac{32}{\pi^2}$$

$\frac{dP}{dL}$ when $P=2$,

$$\frac{dP}{dL} = \frac{\pi}{32}\left(\frac{32}{\pi^2}\cdot\frac{1}{32}\right)^{-1/2}$$

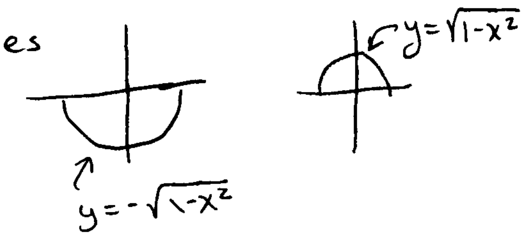
$$= \frac{\pi}{32}\left(\frac{1}{\pi^2}\right)^{-1/2} = \frac{\pi}{32}\cdot\left(\pi^2\right)^{1/2} = \frac{\pi}{32}\cdot\pi = \frac{\pi^2}{32}\ s/ft$$

(65)



$y^2 = 1-x^2$

Think of this as 2 half circles



on the top half, $y=\sqrt{1-x^2}$,

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

The slope should be 2, so

$$\frac{-x}{\sqrt{1-x^2}} = 2 \ ; \ -x = 2\sqrt{1-x^2}$$

$$x^2 = 2(1-x^2)$$

$$x^2 = 2-2x^2$$

$$3x^2 = 2$$

$$x = \sqrt{2/3}.$$

since $x = \sqrt{2/3}$,

$$y = \sqrt{1-x^2} = \sqrt{1-\left(\sqrt{2/3}\right)^2} = \sqrt{1-2/3} = \frac{1}{\sqrt{3}}$$

so the point is $\left(\sqrt{2/3}, \frac{1}{\sqrt{3}}\right)$.

Doing the same thing with $y=-\sqrt{1-x^2}$, we get the point

$\left(-\sqrt{2/3}, \frac{-1}{\sqrt{3}}\right)$