Consider the parabola $y = 6x - x^2$.

(a) Find the slope of the tangent line to the parabola at the point (1, 5).

(b) Find an equation of the tangent line in part (a).

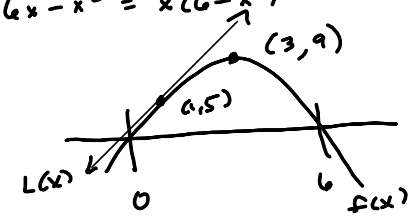
(c) Graph the parabola and the tangent line.

$y' = f'(x) = 6 - 2x$

$f'(1) = 6 - 2 = 4$

$L(x) = 4(x-1) + 5$

$6x - x^2 = x(6-x)$



$h = -\frac{1}{2}gt^2 + v_0 t + h_0$

$h(t) = 15t - 1.86t^2$

$h'(t) = 15 - 3.72t$

$h'(2) = 15 - 3.72(2) = 15 - 7.44 = 7.56$

When will rock hit surface?

M1 Set $h(t) = 0$ & solve.

$15t - 1.86t^2 = 0$

$1.86t^2 - 15t = 0$

$t(1.86t - 15) = 0$

$t = \frac{15}{1.86} \approx 8.06 \approx 8.1$

M2 Set $h'(t) = -v_0$ & solve

$h'(t) = 15 - 3.72t = -15$

$\longrightarrow -3.72t = -30$

$t = \frac{-30}{-3.72} \approx 8.1$

$G(x) = \frac{h(x)}{x}$

$G'(x) = \frac{h'(x)\,x - h(x)}{x^2}$

$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$

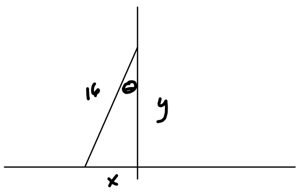
$G'(2) = \frac{(-4)(2) - 3}{2^2} = \frac{-8-3}{4} = -\frac{11}{4}$

$\frac{d}{d\theta}\left[\theta^2 \sin\theta\right] = 2\theta\sin\theta + \theta^2\cos\theta$

$(fg)' = f'g + fg'$

A ladder 16 ft long rests against a vertical wall. Let θ be the angle between the top of the ladder and the wall and let x be the distance from the bottom of the ladder to the wall. If the bottom of the ladder slides away from the wall, how fast (in ft/rad) does x change with respect to θ when $\theta = \frac{\pi}{3}$?

8 ft/rad



$\frac{y}{16} = \cos\theta$

$y = 16\cos\theta$

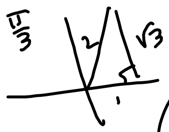
$\Rightarrow y^2 = 16^2\cos^2\theta,$ not $16\cos\theta$

$\frac{x}{y} = \tan\theta$

want $\frac{dx}{d\theta}$

$x = 16\cos\theta\tan\theta$

$\left.\frac{dx}{d\theta}\right|_{\theta=\frac{\pi}{3}} = \left.\left(-16\sin\theta\tan\theta + 16\cos\theta\sec^2\theta\right)\right|_{\theta=\frac{\pi}{3}}$



2.4 answer

$= -16\left(\frac{\sqrt{3}}{2}\right)(\sqrt{3}) + 16\left(\frac{1}{2}\right)(2^2)$

$= -8\cdot3 + 16(2) = -24 + 32 = 8$

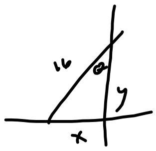
After 2.5 answer

$x^2 + y^2 = 16^2$

$x^2 + 16\cos^2\theta = 16^2$

$2x\frac{dx}{d\theta} + 32\cos\theta(-\sin\theta) = 0$

$\left.\frac{dx}{d\theta}\right|_{\theta=\frac{\pi}{3}} = \left.+\frac{32\cos\theta}{2x}\right|_{\theta=\frac{\pi}{3}}$



$= \frac{+32\cos\frac{\pi}{3}}{32\sin\frac{\pi}{3}} = \frac{+32\left(\frac{1}{2}\right)}{16\sqrt{3}}$

$\frac{x}{16} = \sin\theta$

$x = 16\sin\theta$

$x^2 + 16^2\cos^2\theta = 16^2$

$2x\,x' + 2\cdot16^2\cos\theta(-\sin\theta) = 0$

$x' = \frac{2\cdot16^2\cos\theta\sin\theta}{2(16\sin\theta)}$

$\left.x'\right|_{\theta=\frac{\pi}{3}} = \left.\frac{2\cdot16^2\cos\theta}{2\cdot16}\right|_{\theta=\frac{\pi}{3}} = \left.16\cos\theta\right|_{\theta=\frac{\pi}{3}}$

$= 16\left(\frac{1}{2}\right) = 8$ ✓

Find the limit.

$$\lim_{x \to 0} \frac{\sin(3x)}{4x} \cdot \frac{3x}{3x}$$

$$\lim_{u \to 0} \frac{\sin(u)}{u}$$

$$= \lim_{x\to 0} \left(\left(\frac{\sin(3x)}{4x}\right)\left(\frac{3x}{3x}\right)\right) = \lim_{x \to 0}\left(\left(\frac{\sin(3x)}{3x}\right)\left(\frac{3x}{4x}\right)\right) = \frac{3}{4}\lim_{x\to 0}\frac{\sin(3x)}{3x}$$

$$= \frac{3}{4}(1) = \frac{3}{4}$$

$$4x = \frac{3}{3}\cdot 4x = \frac{4}{3}\cdot 3x$$

Don't do $\sin(3x) = 3\sin(x)$!!

Find the derivative of the function.

$F(x) = (3x^6 + 4x^3)^4$

$F'(x) =$ ✗ $24x^{11}(3x^3+2)(3x^3+4)^3$

$$F'(x) = 4(3x^6+4x^3)^3(18x^5+12x^2)$$

$$= 4(6)\left((x^3)(3x^3+4)\right)^3(3x^3+2)x^2$$

$$= 24x^{11}(3x^3+4)^3(3x^3+2)$$

$$y = (9x^6+4x^3)^4$$

$$y' = 4(9x^6+4x^3)^3(54x^5+12x)$$

$$\frac{d}{dx}\left[x\sin\left(\frac{7}{x}\right)\right] = \sin\left(\frac{7}{x}\right) + x\cos\left(\frac{7}{x}\right)\left(-\frac{7}{x^2}\right)$$

$$y = 7/x = 7x^{-1} \Rightarrow$$

$$y' = -7x^{-2} = -\frac{7}{x^2}$$

$y = \sin(\sin(x))$ @ $(\pi, 0)$

$y'\big|_{x=\pi} = \cos(\sin(x))\cos(x)\big|_{x=\pi}$

$= \cos(0)\cos(\pi) = 1(-1) = -1$

$y = -(x-\pi) + 0$