8) $y = \frac{1}{x^8} = x^{-8}$

$y' = -8x^{-9}$

$y' = \frac{-8}{x^9}$

28) $y = \frac{\pi}{(3x)^2} = \frac{\pi}{9x^2}$

$y = \frac{\pi}{9}x^{-2}$

$y' = \frac{\pi}{9}(-2x^{-3})$

$y' = \frac{-2\pi}{9x^3}$

46) $y = 3x(6x - 5x^2)$

$y = 18x^2 - 15x^3$

$y' = 36x - 45x^2$

48) $y = \dfrac{\sec x}{x}$

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

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

64) Equation of tangent line:

$f(x) = (x-1)(x^2-2), \quad (0,2)$

$x \quad y$

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

$f'(x) = x^2 - 2 + 2x^2 - 2x$

$f'(x) = 3x^2 - 2x - 2$

$f'(0) = 3(0)^2 - 2(0) - 2 = -2$

$y - 2 = -2(x-0)$

or

$y = -2x + 2$

$f(x) = x^3 - 2x - x^2 + 2$

$f'(x) = 3x^2 - 2 - 2x$

2.3 practice

74) Where horizontal tangent line?

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

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

$$2x^5+2x-2x^3$$

$$\frac{2x}{(x^2+1)^2}=0$$

$$2x=0$$

$$x=0$$

94) $f(x)=x+32x^{-2}$, *find* $f''(x)$

$$f'(x)=1-64x^{-3}$$

$$f''(x)=192x^{-4}$$

1/64 x3 192

$$f''(x)=\frac{192}{x^4}$$

10) $f(x) = (9x+2)^{2/3}$

$f'(x) = \frac{2}{3}(9x+2)^{-1/3}(9)$

$f'(x) = \frac{6}{(9x+2)^{1/3}}$

24) $f(x) = x(3x-9)^3$

$f'(x) = 1(3x-9)^3 + (x)(3(3x-9)^2(3))$

$f'(x) = (3x-9)^2((3x-9) + 9x)$

$(3x-9)^2(12x-9)$

$f'(x) = 3(3x-9)^2(4x-3)$

28) $y = \dfrac{x}{\sqrt{x^4+4}}$ $\quad (x^4+4)^{\frac{1}{2}}$

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

$$y' = \frac{\sqrt{x^4+4}}{1} \cdot \frac{(x^4+4)^{\frac{1}{2}}}{(x^4+4)^{\frac{1}{2}}} - \frac{2x^4}{(x^4+4)^{\frac{1}{2}}}$$

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

x^4+4

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

54) $h(t) = 2\cot^2(\pi t + 2)$

$h(t) = 2(\cot(\pi t+2))^2$

$h'(t) = 4(\cot(\pi t+2))(-\csc^2(\pi t+2))(\pi)$

$h'(t) = -4\pi \cot(\pi t+2)\csc^2(\pi t+2)$

72) Equation of tangent line:

$y = \cos(3x), \left(\underset{x}{\pi/4}, \underset{y}{-\sqrt{2}/2}\right)$

$y' = -\sin(3x)(3)$

$y' = -3\sin(3x)$

$y' = -3\sin\left(\frac{3\pi}{4}\right) = -\frac{3\sqrt{2}}{2}$

$y + \frac{\sqrt{2}}{2} = -\frac{3\sqrt{2}}{2}\left(x - \frac{\pi}{4}\right)$

84) $f(x) = \frac{1}{x-2}$, *find* $f''(x)$

$f(x) = (x-2)^{-1}$

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

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

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

8) $\sqrt{xy} = x - 2y$ $\quad (xy)^{\frac{1}{2}} = x - 2y$

$\frac{1}{2}(xy)^{-\frac{1}{2}}(1 \cdot y + x \cdot y') = 1 - 2y'$

$\frac{1}{2}(xy)^{-\frac{1}{2}} y + \frac{1}{2}(xy)^{-\frac{1}{2}}(xy') = 1 - 2y'$

$\frac{xy'}{2(xy)^{\frac{1}{2}}} + 2y' = \frac{-y}{2(xy)^{-\frac{1}{2}}} + 1$

$y'\left(\left(\frac{x}{2\sqrt{xy}}\right) + 2\right) = \frac{-y}{2\sqrt{xy}} + 1 \cdot \frac{2\sqrt{xy}}{2\sqrt{x \cdot y}}$

$\frac{x}{2\sqrt{xy}} + 2 \qquad \frac{x}{2\sqrt{xy}} + 2\,\frac{2 \cdot \sqrt{xy}}{2 \cdot \sqrt{xy}}$

$y' = \dfrac{\frac{-y + 2\sqrt{xy}}{2\sqrt{xy}}}{\frac{x + 4\sqrt{xy}}{2\sqrt{xy}}}$

$y' = \dfrac{2\sqrt{xy} - y}{x + 4\sqrt{xy}}$

28) $x \cos y = 1, \left(2, \frac{\pi}{3}\right)$

$1\cos y + x(-\sin y)y' = 0$

$\cos\left(\frac{\pi}{3}\right) + -2\sin\left(\frac{\pi}{3}\right) y' = 0$

$\frac{1}{2} - 2\left(\frac{\sqrt{3}}{2}\right) y' = 0$

$-\sqrt{3}\, y' = -\frac{1}{2}$

$y' = \frac{1}{2\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}}$ or $y' = \frac{\sqrt{3}}{6}$

48) $1 - xy = x - y$, *find* y''

$0 - (1 \cdot y + xy') = 1 - y'$

$-1y - xy' = 1 - y'$

$y' - xy' = 1 + y$

$\frac{y'(1-x)}{1-x} = \frac{y+1}{1-x}$

$y' = \frac{y+1}{1-x}$

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

$y'' = \frac{\left(\frac{y+1}{1-x}\right)(1-x) + y + 1}{(1-x)^2}$

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

2) $x^2 + y^2 = 25$ Find $\frac{dy}{dt}$ when $x = 3, y = 4$: Given $\frac{dx}{dt} = 8$

$2x\frac{dx}{dt} + 2y\frac{dy}{dt} = 0$

$2(3)(8) + 2(4)\frac{dy}{dt} = 0$

$-48 \quad 8 \quad -48$

$\frac{8\frac{dy}{dt}}{8} = \frac{-48}{8}$

$\frac{dy}{dt} = -6$

16) Area of a circle changing in respect to time.

$A = \pi r^2$ $\frac{dA}{dt} = \pi(2r)\frac{dr}{dt}$

22) Find rate of change of the volume if $\frac{dr}{dt} = 2$ and $h = 3r$ when $r = 6$

$V = \frac{1}{3}\pi r^2 h$

$V = \frac{1}{3}\pi r^2(3r)$ $\quad V = \pi r^3$

$\frac{dV}{dt} = \pi(3r^2)\frac{dr}{dt}$

$\frac{dV}{dt} = \pi(3(6)^2)(2)$

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$\frac{dV}{dt} = 216\pi$