SM121 LESSON 23 3/6/7/10/12/15/23/25/29/31/38/52/58

SECTION 3.1 DERIVATIVES OF POLYNOMIALS 10/1/2006

(3) $f(x) = 186.5$

$\boxed{f'(x) = 0}$

(6) $F(x) = \frac{3}{4}x^8$ $\boxed{F'(x) = 6x^7}$

(7) $f(x) = x^3 - 4x + 6$ $\boxed{f'(x) = 3x^2 - 4}$

(10) $h(x) = (x-2)(2x+3)$

$= 2x^2 + 3x - 4x - 6$

$h(x) = 2x^2 - x - 6$ $\boxed{h'(x) = 4x - 1}$

(12) $y = 5e^x + 3$ $\boxed{y' = 5e^x}$

(15) $A(s) = -\frac{12}{s^5}$

$A(s) = -12s^{-5}$

$A'(s) = (-12)(-5)s^{-6}$

$A'(s) = 60s^{-6}$

$\boxed{A'(s) = \frac{60}{s^6}}$

LESSON 23 10/1/2008

(23) $y = \dfrac{x^2+4x+3}{\sqrt{x}}$

$y = \dfrac{x^2}{x^{\frac{1}{2}}} + \dfrac{4x}{x^{\frac{1}{2}}} + \dfrac{3}{x^{\frac{1}{2}}}$

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

$y = x^{\frac{3}{2}} + 4x^{\frac{1}{2}} + 3x^{-\frac{1}{2}}$

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

$y' = \dfrac{3\sqrt{x}}{2} + \dfrac{2}{\sqrt{x}} - \dfrac{3}{2x\sqrt{x}}$

$y' = \left(\dfrac{3\sqrt{x}}{2}\right)\dfrac{x\sqrt{x}}{x\sqrt{x}} + \left(\dfrac{2}{\sqrt{x}}\right)\left(\dfrac{2x}{2x}\right) - \dfrac{3}{2x\sqrt{x}}$

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

$$\boxed{y' = \frac{3x^2+4x-3}{2x\sqrt{x}}}$$

(25) $y = 4\pi^2$ $\boxed{y' = 0}$

(29) $u = \sqrt[5]{t} + 4\sqrt{t^5}$

$u = t^{\frac{1}{5}} + 4t^{\frac{5}{2}}$

$u' = \frac{1}{5}t^{-\frac{4}{5}} + 4\left(\frac{5}{2}t^{\frac{3}{2}}\right)$

$$\boxed{u' = \frac{1}{5\sqrt[5]{t^4}} + 10\sqrt{t^3}}$$

LESSON 23 10/1/2008

(31) $z = \frac{A}{y^{10}} + Be^{y}$

$z = Ay^{-10} + Be^{y}$ $\qquad$ $z' = -10Ay^{-11} + Be^{y}$

$$\boxed{z' = \frac{-10A}{y^{11}} + Be^{y}}$$

(38) FIND TANGENT LINE TO $y = x - \sqrt{x}$ AT $(1, 0)$

$y = x - x^{\frac{1}{2}}$ $\qquad$ $y' = 1 - \frac{1}{2}x^{-\frac{1}{2}}$

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

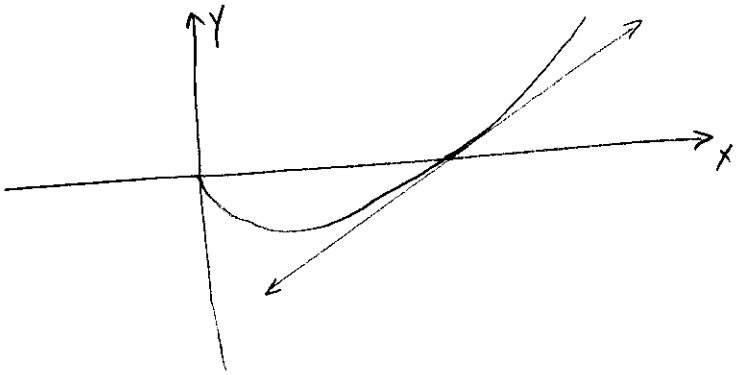
$y - y_1 = m(x - x_1)$ $\qquad$ $y'(1) = 1 - \frac{1}{2\sqrt{1}}$

$= 1 - \frac{1}{2}$

$y - 0 = \frac{1}{2}(x - 1)$

$$\boxed{y = \frac{1}{2}x - \frac{1}{2}}$$

$y'(1) = \frac{1}{2}$



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(52) FOR WHAT VALUES OF $f(x) = x^3 + 3x^2 + x + 3$ HAVE A HORIZONTAL TANGENT?

$$f'(x) = 3x^2 + 6x + 1$$

SET $f'(x) = 0$ AND SOLVE

$$0 = 3x^2 + 6x + 1$$

CANNOT FACTOR. USE QUADRADIC FORMULA TO FIND ROOTS

$$x = \frac{-6 \pm \sqrt{36 - 4(3)(1)}}{6}$$

$$x = \frac{-6 \pm \sqrt{36 - 12}}{6}$$

$$x = -1 \pm \frac{\sqrt{24}}{6}$$

$$x = -1 \pm \frac{\sqrt{4 \cdot 6}}{6}$$

$$x = -1 \pm \frac{2\sqrt{6}}{6}$$

$$\boxed{x = -1 \pm \frac{\sqrt{6}}{3}}$$

LESSON 23 10/1/2008

(56) WHERE DOES THE NORMAL LINE TO $y = x - x^2$ AT $(1, 0)$ INTERCEPT THE PARABOLA AGAIN?

$y' = 1 - 2x$

$y'(1) = 1 - 2(1)$

$= 1 - 2$

$y'(1) = -1$

$m_N = -\frac{1}{m}$

$m_N = -\frac{1}{-1} = 1$

$y - y_1 = m(x - x_1)$

$y - 0 = 1(x - 1)$

$y = x - 1$ NORMAL LINE

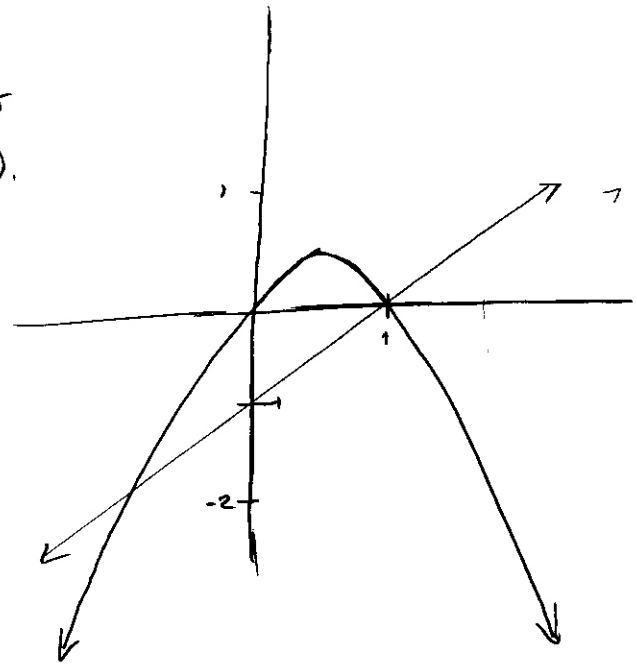
$x - 1 = x - x^2$

$x^2 - 1 = 0$

$(x-1)(x+1) = 0$

$x = 1 \quad x = -1$

$y(1) = 1 - (1)^2 = 0$

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

NORMAL LINE INTERCEPTS THE PARABOLA AT $(1, 0)$, THE POINT OF TANGENCY, AND $(-1, -2)$.