(3a) $y = \frac{x^3}{2}$ at point $(-1, -\frac{1}{2})$

$\left.\frac{dy}{dx}\right|_{x=1} = \frac{3x^2}{2}$

$m = \frac{3(1)^2}{2}$

$m = 3/2 \quad x_1 = -1 \quad y_1 = -\frac{1}{2}$

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

$y - -\frac{1}{2} = \frac{3}{2}(x - -1)$

$y + \frac{1}{2} = 3/2(x+1)$

$2y + 1 = 3(x+1)$

$2y + 1 = 3x + 3$

$2y - 3x + 1 - 3 = 0$

$2y - 3x - 2 = 0$ equation of a tangent

3b equation of a normal

$m_1 m_2 = -1$

$m_2 = -\frac{1}{m_1}$

$m_2 = \frac{-1}{3/2}$

$m_2 = -2/3$

$y - y_1 = m_2(x - x_1)$

$y - -\frac{1}{2} = \frac{2}{3}(x - -1)$

$y + \frac{1}{2} = \frac{-2}{3}(x+1)$

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

multiply all through by 2

$6y + 3 = -4x - 4$

$6y + 4x + 3 + 4 = 0$

$6y + 4x + 7 = 0$

(4) $y = 1 + x - x^2$ at point $(-2, -5)$ 5m

$\left.\frac{dy}{dx}\right|_{x=1} = 0 + 1 - 2x$

$m = 1 - 2x$

$m = 1 - 2(1)$

$m = 1 - 2$

$m = -1 \quad x_1 = -2, \; y_1 = -5$

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

$y - -5 = -1(x - -2)$

$y + 5 = -1(x+2)$

$y + 5 = -x - 2$

$y + x + 5 + 2 = 0$

$y + x + 7 = 0$ equation of the tangent

(4b) Equation of Normal

$m_1 m_2 = -1$

$m_2 = -\frac{1}{m_1}$

$m_2 = \frac{-1}{-1}$

$m_2 = 1$

$y - -5 = 1(x - -2)$

$y + 5 = 1(x + 2)$

$y + 5 = x + 2$

$y + y - x + 5 - 2 = 0$

$y - x + 3 = 0$

equation of the normal

(5)

5a $y = \frac{1}{x}$ at point $(3, \frac{1}{3})$

$\frac{dy}{dx} = x^{-1}$

$= -1x^{-1-1}$

$-1x^{-2}$

$m = -1x^{-2}$ $-1/x^2$

$m = \frac{-1}{-1}$ $m = -1/x^2$

$m = \frac{1}{2}$ $m = -1/1^2$

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

$m = -1$

$x_1 = 3, y_1 = 1/3$

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

$y - \frac{1}{3} = -1(x - 3)$

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

$3y - 1 = -3x + 9$

$3y + 3x - 1 - 9 = 0$

$3y + 3x - 10 = 0$ <equation of the tangent>

(b) equation of the normal

$m_2 = \frac{-1}{m_1}$

$m_2 = \frac{-1}{-1}$

$m_2 = 1$

$y - y_1 = 1(x - 3)$

$y - \frac{1}{3} = x - 3$

$3y - 1 = 3x - 9$

$3y - 3x - 1 + 9 = 0$

$3y - 3x + 8 = 0$

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For the curves in problem 1 to 5, at the points given. Find (a) the equation of the tangent and (b) the equation of the normal

1. $y = 2x^2$ at the point (1,2)
2. $y = 3x^2 - 2x$ at the point (2,8)
3. $y = x^2/2$ at the point $(-1, -1/2)$
4. $y = 1 + x - x^2$ at the point (-2,-5)
5. $y = 1/x$ at the point (3, 1/3)

1) $y = 2x^2$

$\left.\frac{dy}{dx}\right|_{x \to 1} = 4x$

$m = 4 \times 1$

$m = 4$

$x_1 = 1,\ y_1 = 2$

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

$y - 2 = 4(x - 1)$

$y - 2 = 4x - 4$

$y = 4x - 4 + 2$

$y = 4x - 2$ <Equation of a tangent>

1(B) Equation of a normal

$m_1 m_2 = -1$

$m_2 = \frac{-1}{m_1}$

$m_2 = -1/4$

$y - y_1 = m_2(x - x_1)$

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

$4y - 8 = -x + 1$

$4y + x - 8 - 1 = 0$

$4y + x - 9 = 0$

equation of the normal

(2a) $y = 3x^2 - 2x$ (2,8)

$\left.\frac{dy}{dx}\right|_{x \to 1} = 6x - 2$

$m = 6(1) - 2$

$m = 4$

$y_1 = 8,\ x_1 = 2$

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

$y - 8 = 4(x - 2)$

$y - 8 = 4x - 8$

$y = 4x - 8 + 8$

$y = 4x + 0$ (equation of the tangent)

B) Equation of the Normal

$m_1 m_2 = -1$

$4 \cdot m_2 = -1$

$m_2 = -1/4$

$y - y_1 = m_2(x - x_1)$

$y - 8 = -1/4(x - 2)$

$4y - 32 = -x + 2$

$4y + x - 32 - 2 = 0$

$4y + x - 34 = 0$