NAME: ABIDAKUN DAMILOLA FAITH
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① $y = 2x^2$ at the point (1,2)

Equation of the tangent

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

Since $y = 2x^2$

$\frac{dy}{dx} = 4x$

$\frac{dy}{dx}_{(1,2)} = 4(1)$

$\frac{dy}{dx} = 4$

$\therefore m = \frac{dy}{dx} = 4.$

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

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

$y - 2 = 4x - 4$

$y - 4x = -4 + 2$

$y - 4x = -2$

$y - 4x + 2 = 0.$

Eq. of normal

$y - y_1 = -1/m(x - x_1)$

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

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

$4y - 8 = -x + 1$

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

$4y + x - 9 = 0.$

Equation of normal

$y - y_1 = -1/m(x - x_1)$

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

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

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

$5y + 25 = -x - 2$

$5y + 25 + x + 2 = 0$

$5y + x + 27 = 0$.

(5) $y = 1/x$ at the point $(3, 1/3)$

$y = x^{-1}$

$\frac{dy}{dx} = -x^{-2}$

$\frac{dy}{dx}_{\text{limit } x=3} = -3^{-2}$

$\frac{dy}{dx}_{\text{limit } x=3} = \frac{1}{(-3)^2}$

$\frac{dy}{dx}_{\text{limit } x=3} = -\frac{1}{9}$

$m = \frac{dy}{dx} = -\frac{1}{9}$

Equation of tangent

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

$y - 1/3 = -1/9(x - 3)$

$9(y - 1/3) = -1(x - 3)$

$9y - 3 = -x + 3$

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

$9y + x - 6 = 0$

Equation of normal

$y - y_1 = -1/m(x - x_1)$

$y - 1/3 = -1/-1/9(x - 3)$

③ $y = x^{3/2}$ at the point $(-1, -1/2)$

$$\frac{dy}{dx} = \frac{1}{2}x^{\cdot}$$

$$\frac{dy}{dx} = \frac{3x^{\cdot}}{2}$$

$$\frac{dy}{dx} = \frac{3x^{\cdot}}{2}$$

②

$$\frac{dy}{dx} = \frac{3(-1)^{\cdot}}{2}$$

$$\frac{dy}{dx} = \frac{3}{2}$$

$$\therefore m = \frac{dy}{dx} = \frac{3}{2}$$

Equation of tangent

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

$$y - (-1/2) = 3/2\,(x - (-1))$$

$$y + 1/2 = 3/2\,(x + 1)$$

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

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

Multiply both sides by 2

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

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

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

$$2y - 3x - 2 = 0.$$

Equation of normal

$$y - y_1 = -1/m\,(x - x_1)$$

$$y - (-1/2) = -1/3/2\,(x - (-1))$$

$-1/9(y-1/3)=-1(x-3)$

$\frac{-3y+1}{27}=-x+3$

Cross multiply

$-3y+1=27(-x+3)$

$-3y+1=-27x+81$

$-3y+1+27x-81=0$

$-3y+27x-80=0$

$\therefore 3y-27x+80=0.$

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

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

② $\frac{6y+3}{4} = -x-1$

Cross multiply

$6y+3 = 4(-x-1)$

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

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

$6y+4x+7=0$

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

$\frac{dy}{dx} = 1-2x$

$\frac{dy}{dx} = 1-2(-2)$

$\lim_{x \to -2} = 1-(-4)$

$= 1+4$

$dy/dx = 5.$

$\therefore \frac{dy}{dx} = m = 5.$

Equation of tangent

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

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

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

$y+5 = 5x+10$

$y+5-5x-10=0$

$y-5x-5=0$

② $y = 3x^2 - 2x$ at the point $(2, 8)$

$$\frac{dy}{dx} = 6x - 2$$

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

$$= 12 - 2$$

$$= 10.$$

$$\therefore m = \frac{dy}{dx} = 10$$

Equation of tangent

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

$$y - 8 = 10(x - 2)$$

$$y - 8 = 10x - 20$$

$$y - 10x - 8 + 20 = 0$$

$$y - 10x + 12 = 0$$

Equation of normal

$$y - y_1 = -1/m(x - x_1)$$

$$y - 8 = -1/10(x - 2)$$

$$10(y - 8) = -1(x - 2)$$

$$10y - 80 = -x + 2$$

$$10y - 80 = -x + 2$$

$$10y - 80 + x - 2 = 0$$

$$10y + x - 80 - 2 = 0$$

$$10y + x - 82 = 0.$$