$$f(x) = \begin{cases} 3 - x, & x < 1 \\ ax^2 + bx, & x \ge 1 \end{cases}$$

where a and b are constants.

$$3-1 = a(1)^{2} + b(1)$$

(a) If the function is continuous for all x, what is the relationship between a and b?

Find the unique values for a and b that will make f both continuous and differentiable.

$$\frac{-1}{m} = 2ax + b$$

$$2-a=b$$
 $-1=2a+2-9$ 
 $-3=9$ 

**37.** Find an equation of the line perpendicular to the tangent to the curve 
$$y = x^3 - 3x + 1$$
 at the point  $(2, 3)$ 

curve 
$$y = x^3 - 3x + 1$$
 at the point  $(2, 3)$ 
Tangen  $\pm$ 

$$\frac{dy}{dx} = 3x^{2} - 3$$
;  $\frac{dy}{dx} = 3(2)^{2} - 3 = 9 = m$ 

$$\begin{vmatrix} -3x - 3 & -3 \\ -3x - 3 & -3 \end{vmatrix} = 5(2)^{-3} = 1 - 10$$

$$x = 2$$

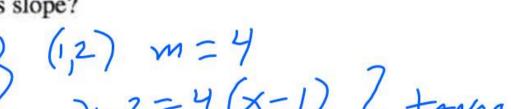
$$y - 3 = 9(x - 2)$$

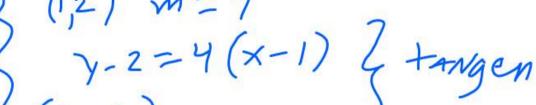
$$\begin{array}{l} x \\ x=2 \\ y-3=9(x-2) \\ Perpendicular \\ y-3=-\frac{1}{9}(x-2) \end{array}$$

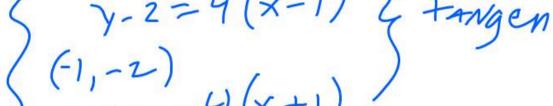
**38.** Find the tangents to the curve  $y = x^3 + x$  at the points where the slope is 4. What is the smallest slope of the curve? At what value of x does the curve have this slope?

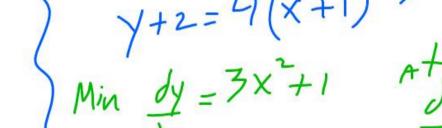
the slope is 4. What is the smallest slope of the curve? At what value of x does the curve have this slope?

$$\frac{dy}{dx} = \frac{3x^2 + 1}{3x^2 + 1} = \frac{4}{3x^2 +$$









$$|X|^{3} + 1$$

$$|X| = 1$$

$$|Y| = 2$$

$$|X| = 3x^{2} + 1$$

$$|X| = 0$$

$$|X| = 3x^{2} + 1$$

$$|X| = 0$$

$$|X| = 1$$

$$|X| = 0$$

$$|X| = 1$$

In Exercises 7–12, find the horizontal tangents of the curve.

**12.** 
$$y = x^4 - 7x^3 + 2x^2 + 15$$

$$\frac{dy}{dx} = 4x^3 - 21x^2 + 4x = 0$$

$$X\left(4x^{2}-21x+4\right)=0$$

$$X (4x^{2}-21x+4) = 0$$

$$X = -(-21) \pm \sqrt{(21)^{2}-4/4}(4)$$

$$= 21 \pm \sqrt{(44)^{2}-64}$$
8

$$= \frac{21 \pm \sqrt{377}}{8}$$

$$D y = )5$$

In Exercises 27 and 28, find an equation for the line tangent to the curve at the given point.

Rewrite
$$y = x^{2} + 2 x^{-2}$$

$$y = x^{4} + 2 x^{-2}$$

curve at the given point.  

$$y = x^{2} + 2x^{-2}$$

$$\frac{dy}{dx} = zx - 4x^{-3}$$

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

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

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

 $\frac{\partial y}{\partial x} \Big|_{x=-1} = 2(-1) - 4(-1)^{-3} = -2 - 4 = -2 + 4 = 2$ 

 $\gamma - 3 = 2(x + 1)$ 

32. 
$$y = 2\sqrt{x} - \frac{1}{\sqrt{x}} = 2x^{\frac{1}{2}} - x^{-\frac{1}{2}}$$

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

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

 $= \frac{1}{\sqrt{X}} + \frac{1}{2\sqrt{X^3}}$