

Find the derivative of the given function.

$$31) y = \tan^{-1} \sqrt{3x}$$

$$\frac{d}{dx}(\tan^{-1} u) = \frac{1}{1+u^2} u'$$

$$u = (3x)^{\frac{1}{2}}$$
$$\frac{du}{dx} = \frac{1}{2} (3x)^{-\frac{1}{2}} \cdot 3$$
$$u' = \frac{3}{2\sqrt{3x}}$$

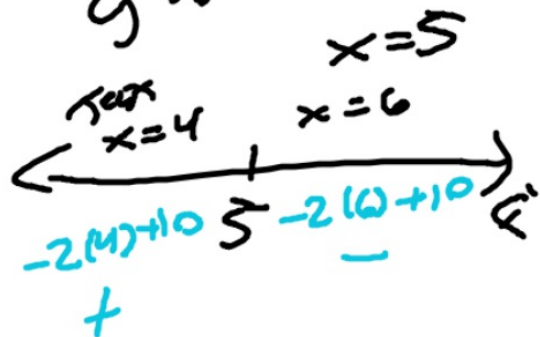
$$y' = \frac{1}{1+3x} \left(\frac{3}{2\sqrt{3}} \right)$$
$$= \frac{3}{(2\sqrt{3})(1+3x)}$$

ind the extreme values of the function and where they occur.

33) $y = \frac{4x}{x^2 + 1}$

32

$$g(x) = -x^2 + 10x - 21$$
$$g'(x) = -2x + 10 = 0$$



33) _____

$$g(3) = -(3)^2 + 10(3) - 21 = 0$$

min

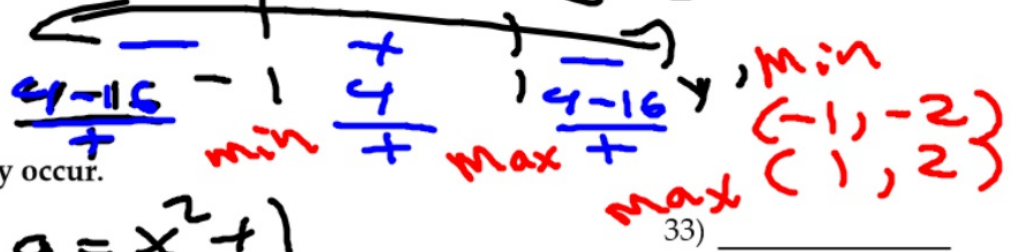
$$g(5) = -(5)^2 + 10(5) - 21 = 4$$

max

$$g(7) = -(7)^2 + 10(7) - 21 = 0$$

min

Test $x = -2$ $x = 0$ $x = 2$



Find the extreme values of the function and where they occur.

33) $y = \frac{4x}{x^2 + 1}$

$f = 4x$ $g = x^2 + 1$

$f' = 4$ $g' = 2x$

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

$y' = \frac{(x^2 + 1)(4) - (4x)(2x)}{(x^2 + 1)^2} = 0$

$-x^2 = 0$

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

$x = \pm 1$

$4x^2 + 4 - 8x^2 = 0$

$4 - 4x^2 = 0$

$f(-1) = \frac{-4}{1+1} = -2$

$f(1) = \frac{4}{1+1} = 2$

33) _____

Give an appropriate answer.

34) Find the value or values of c that satisfy $\frac{f(b) - f(a)}{b - a} = f'(c)$ for the function $f(x) = x + \frac{27}{x}$ on

the interval $[3, 9]$

34) _____

$$f(3) = 3 + \frac{27}{3}$$

$$3 + 9 = 12$$

$$f(9) = 9 + \frac{27}{9} = 12$$

$$\frac{12 - 12}{9 - 3} = 1 - 27x^{-2}$$

$$0 = 1 - \frac{27}{x^2}$$

$$f(x) = x + 27x^{-1}$$
$$f'(x) = 1 - 27x^{-2}$$

$$\frac{27}{x^2} = 1$$
$$27 = x^2$$
$$x = \pm 3\sqrt{3}$$

$\sqrt{27}$
 $3\sqrt{3}$
 $-3\sqrt{3}$

is decreasing.

37) $f(x) = x^4 - 2$

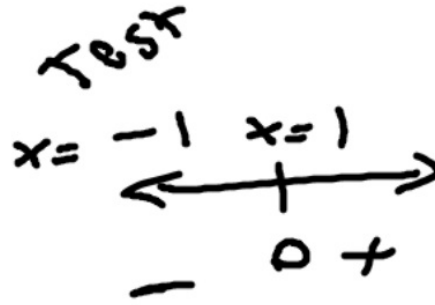
37) _____

37

$$f(x) = x^4 - 2$$

$$f'(x) = 4x^3 = 0$$

$$x = 0$$



increasing: $(0, \infty)$

decreasing: $(-\infty, 0)$

Find all possible functions with the given derivative.

38) $f'(x) = 4 \cos 4x$

38) _____

Find the function with the given derivative whose graph passes through the point P.

39) $f'(x) = x^2 + 9$ P(3, 55)

39) _____

38

$$f(x) = \sin(4x) + C$$

39

$$f(x) = \frac{1}{3}x^3 + 9x + C$$

$$55 = \frac{1}{3}(27) + 9(3) + C$$

$$55 = 9 + 27 + C$$

$$55 = 36 + C \quad C = 19$$

$$f(x) = \frac{1}{3}x^3 + 9x + 19$$

Find the points of inflection.

$$40) y = \frac{4}{3}x^3 - 12x^2 + 10x + 50$$

$$y' = 4x^2 - 24x + 10$$

$$y'' = 8x - 24 = 0$$
$$\begin{array}{r} +24 \quad +24 \\ \hline x = 3 \end{array}$$

$$x = 2 \quad x = 4$$
$$\begin{array}{c} \leftarrow \quad \quad \quad \rightarrow \\ - \quad 3 \quad + \end{array} \quad y''$$

$$\textcircled{40} \quad \frac{4}{3}(27) - 12(9) + 80$$
$$36 - 108 + 80$$
$$116 - 108 = 8$$

$$40) \quad \underline{\underline{(3, 8)}}$$