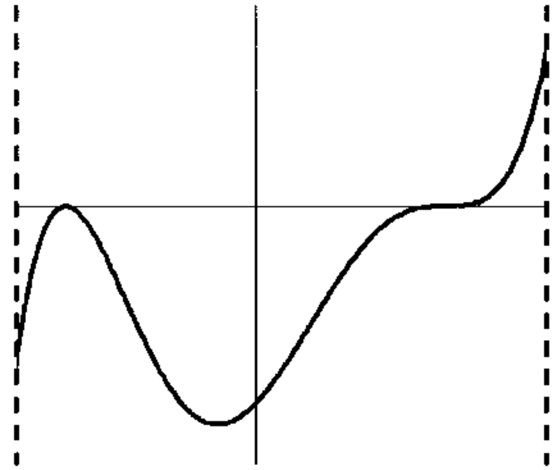
Name_______________________________

1) For each function **f(x)** below, determine the number of...

FIND HOW MANY

Domain is all x values between dashed lines.



__3__ Critical Points

__1__ Relative Maximums

__1__ Relative Minimums

__1__ Absolute Maximums

__1__ Absolute Minimums

__3__ Inflection Points

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__3__ Critical Points

__1__ Relative Maximums

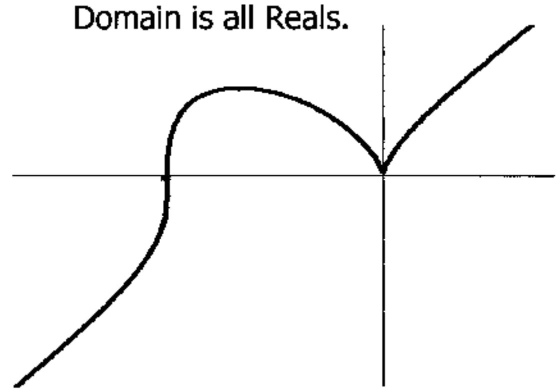
__1__ Relative Minimums

__0__ Absolute Maximums

__0__ Absolute Minimums

__1__ Inflection Points

Domain is all Reals.



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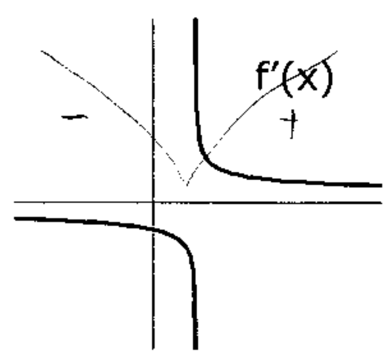
2) The graph of **f′(x)** is shown below. Given that the original function, f(x), is defined for all real numbers, which must be true about the original function?

(1) f(x) has 1 critical point which is a local (relative) maximum.

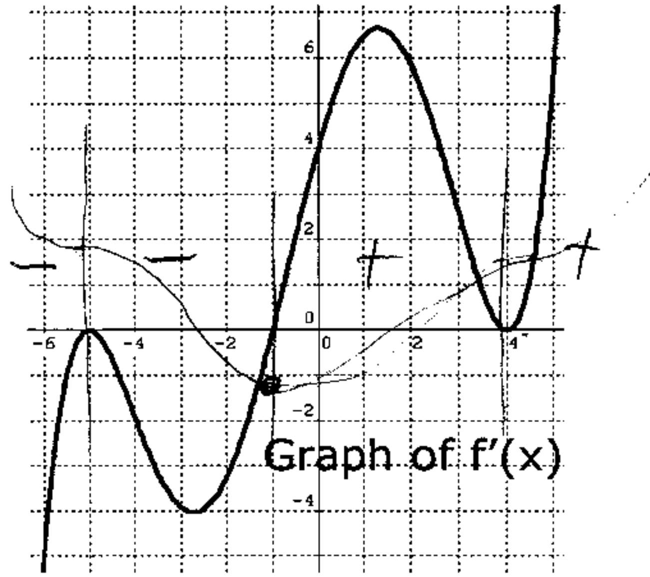
(2) f(x) has 1 critical point which is a local (relative) minimum.

(3) f(x) has 1 critical point which not a maximum or minimum.

(4) f(x) has no critical points.



3) Use the graph of **f′(x)** shown to determine **at which x-values** the original function f(x) has...




Critical point(s) at x = $-5, -1, 4$

Relative maximum(s) at x = NONE

Relative minimum(s) at x = $-1$

4) Use the **first derivative** and **second derivative** to determine the x-values of the critical points, maximums and minimums, concavity, and inflection points. Then sketch a curve that approximates the function.

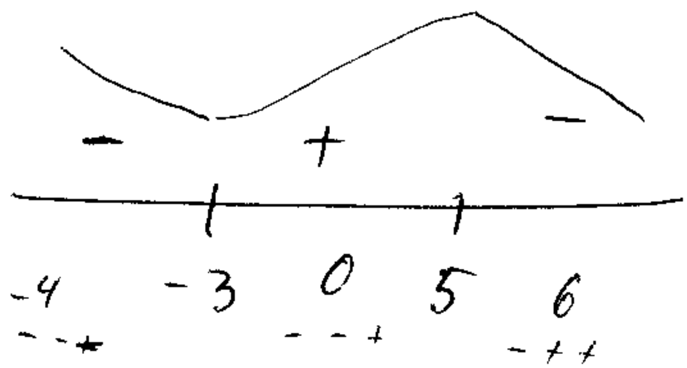
$$f(x) = -\frac{1}{3}x^3 + x^2 + 15x$$

$$f'(x) = -x^2 + 2x + 15$$

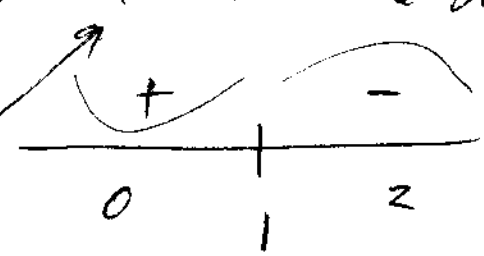
$$0 = -1(x^2 - 2x - 15)$$

$$0 = -1(x-5)(x+3)$$

$x = 5 \quad x = -3$




$$f''(x) = -2x + 2$$




$-2x + 2 = 0$

$-2x = -2$

$x = 1$

Critical Point(s): $x = 5, x = -3$

Local Maximum(s): $x = 5$

Local Minimum(s): $x = -3$

Inflection Point(s): $x = 1$

5) Given the **first** derivative of a function $f'(x) = 6(x-1)(x+2)^2$ determine the x-values of the critical points, maximums and minimums of the original function.

$-\quad -\quad -\quad +$

$-3 \quad -2 \quad 0 \quad 1 \quad 2$

$-+ \qquad -+$

Critical Point(s): $X=-2,\ X=1$

Maximum(s): NONE

Minimum(s): $X=1$

6) Given the **second** derivative of a function $f''(x) = (x^2-9)(x^2+3x)$ determine the x-values of the inflection points of the original function.

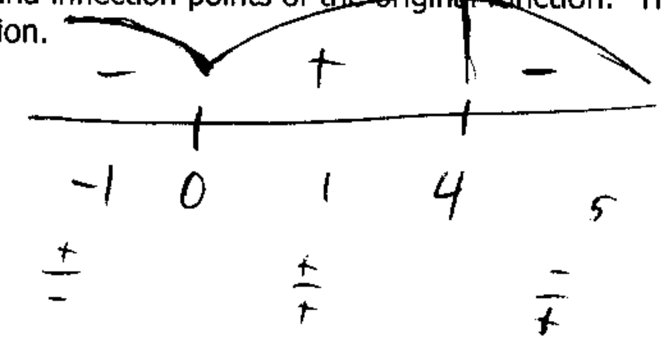
$0=(X+3)(X-3)(X)(X+3)$

$+\quad +\quad -\quad +$

$-4 \quad -3 \quad -1 \quad 0 \quad 1 \quad 3 \quad 4$

Inflection Point(s): $X=0,\ X=3$

7) Given the **first** derivative of a function $f'(x) = \dfrac{4-x}{x}$ determine the x-values of the critical points, maximums, minimums, and inflection points of ~~the original~~ function. Then sketch a curve that approximates the function.




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

Critical Point(s) at x = 0, 4

Maximum(s) at x = 4

Minimum(s) at x = 0

Inflection Point(s) at x = NONE

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

$$f''(x) = \frac{-4}{x^2}$$

Sketch of f(x):

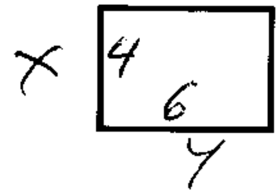
always negative
concave down

**Bonus**: The length of a rectangle is decreasing at a rate of 2 cm/sec while the width is increasing at a rate 3 cm/sec. When the length is 6 cm and the width is 4 cm find the rate of change of the area.

$A = xy$

$\frac{dy}{dt} = -2$

$\frac{dx}{dt} = 3$




$$\frac{dA}{dt} = \frac{dx}{dt}y + x\frac{dy}{dt}$$

$$\frac{dA}{dt} = (3)(6) + (4)(-2)$$

$$\boxed{\frac{dA}{dt} = 10}$$