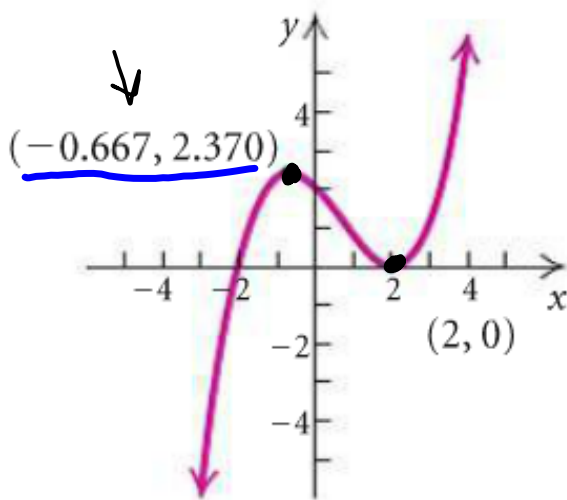


Using the graph, determine any relative maxima or minima of the function and the intervals on which the function is increasing or decreasing.

15. $f(x) = \frac{1}{4}x^3 - \frac{1}{2}x^2 - x + 2$



We have a relative maximum at $x = -0.667$
The maximum is $y = 2.370$

As ordered pair: $(-0.667, 2.370)$

We have a relative minimum at $x = 2$
The minimum is $y = 0$

As ordered pair: $(2, 0)$

It is increasing when $x \in (-\infty, -0.667) \cup (2, \infty)$

It is decreasing when $x \in (-0.667, 2)$

Graph the function using the given viewing window. Find the intervals on which the function is increasing or decreasing and find any relative maxima or minima. Change the viewing window if it seems appropriate for further analysis.

Calculator gives approx. but is generally accurate 3 decimal places.

23. $f(x) = -x^3 + 6x^2 - 9x - 4$

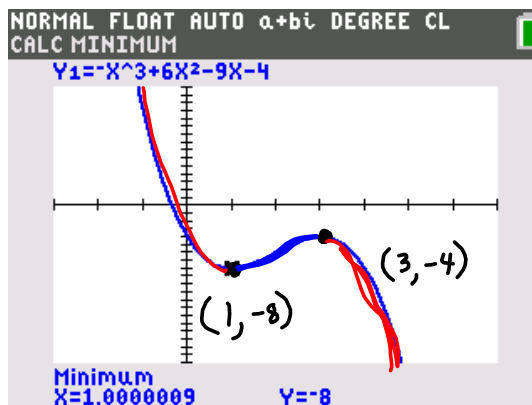
$\star [-3, 7, -20, 15]$
 $\downarrow \quad \downarrow \quad \downarrow \quad \downarrow$
 $x_{min} \quad x_{max} \quad y_{min} \quad y_{max}$

rel min @ $(1, -8)$

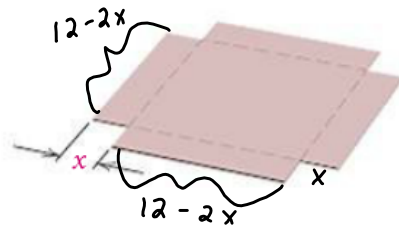
rel max @ $(3, -4)$

inc: $x \in (1, 3)$

dec: $x \in (-\infty, 1) \cup (3, \infty)$



44. **Volume of a Box.** From a 12-cm by 12-cm piece of cardboard, square corners are cut out so that the sides can be folded up to make a box.



$$\begin{aligned} \text{height} &= x > 0 \\ \text{width} &= 12 - 2x \\ \text{length} &= 12 - 2x \end{aligned}$$

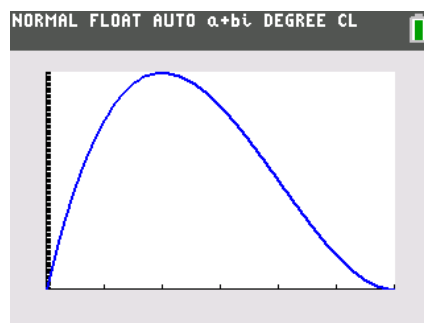
$$\begin{aligned} 12 - 2x &> 0 \\ -2x &> -12 \\ x &< 6 \end{aligned}$$

- Express the volume of the box as a function of the side x , in centimeters, of a cut-out square.
- Find the domain of the function.
- Graph the function with a graphing calculator.
- What dimensions yield the maximum volume?

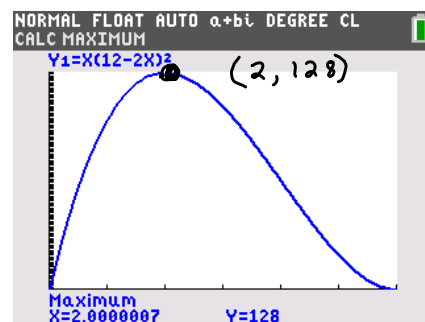
$$\begin{aligned} \text{a) } V &= lwh \\ V(x) &= x(12 - 2x)^2 \end{aligned}$$

$$\text{b) } \underline{0 < x < 6} \quad x \in (0, 6)$$

c)



d)



$$\begin{aligned} \text{height} &= x = 2 \text{ cm} \\ \text{length} &= 12 - 2x = 8 \text{ cm} \\ \text{width} &= 12 - 2x = 8 \text{ cm} \end{aligned}$$

$$V_{\max}(2) = 128 \text{ cm}^3$$

Boolean Algebra

$$0 = \text{false} \quad | \quad (7 < 13) = 1$$

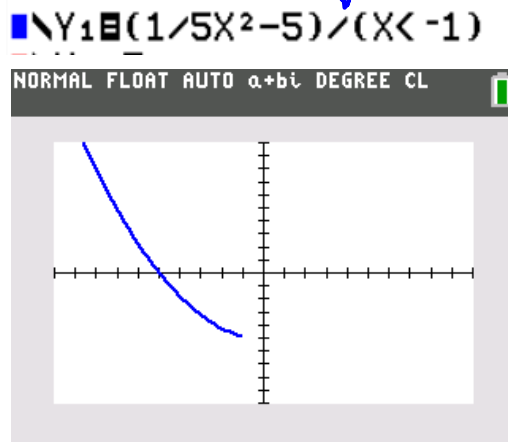
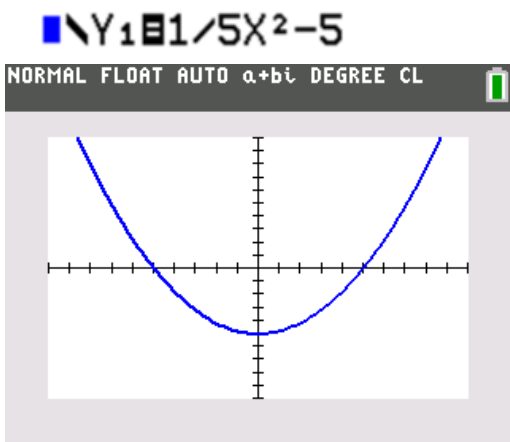
$$1 = \text{true} \quad | \quad (3 > 27) = 0$$

Graph $f(x) = \frac{1}{5}x^2 - 4$ for $x < -1$

$f(x) = \frac{1}{5}x^2 - 4$ for $-3 < x < 2$

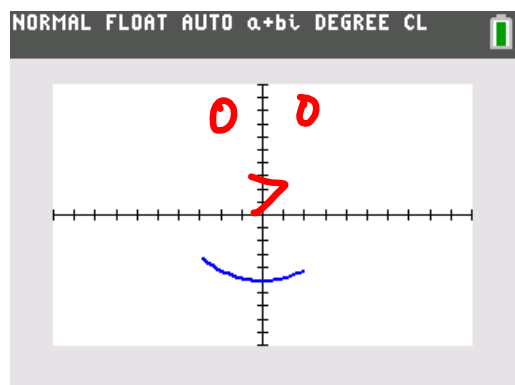
$(-3 < x)$ and $(x < 2)$
 $(-3 > x) \times (x < 2)$
times

When false, $\div 0$
 When true, $\div 1$



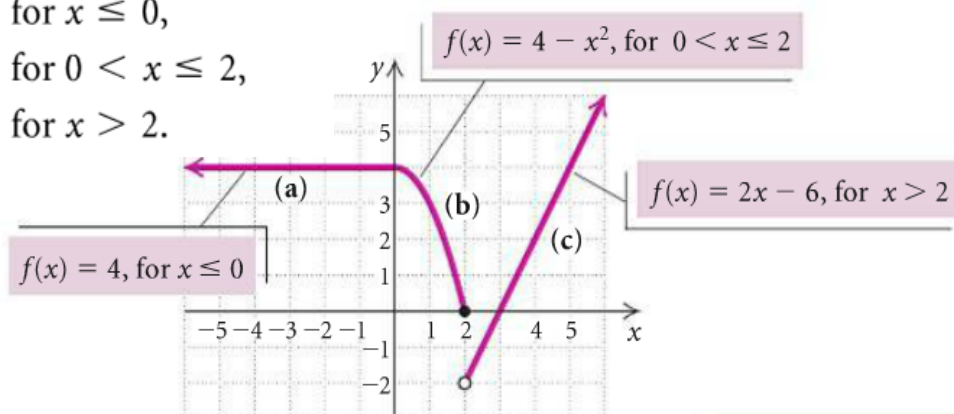
$Y1 = (1/5X^2 - 5) / ((-3 < X)(X < 2))$

if either is false (0), $\div 0$
 if both are true (1), $\div 1$



Graph the function defined as

$$f(x) = \begin{cases} 4, & \text{for } x \leq 0, \\ 4 - x^2, & \text{for } 0 < x \leq 2, \\ 2x - 6, & \text{for } x > 2. \end{cases}$$



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Plot1 Plot2 Plot3

$$\blacksquare Y_1 = 4 / (X \leq 0)$$

$$\blacksquare Y_2 = (4 - X^2) / ((X > 0) (X \leq 2))$$

$$\blacksquare Y_3 = (2X - 6) / (X > 2)$$

$$\blacksquare Y_4 =$$

$$\blacksquare Y_5 =$$

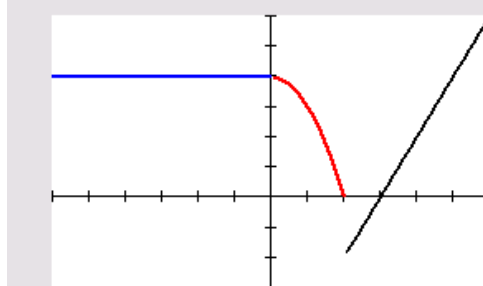
$$\blacksquare Y_6 =$$

$$\blacksquare Y_7 =$$

$$\blacksquare Y_8 =$$

$$\blacksquare Y_9 =$$

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For each piecewise function, find the specified function values.

$$47. g(x) = \begin{cases} x + 4, & \text{for } x \leq 1, \\ 8 - x, & \text{for } x > 1 \end{cases}$$

$$\textcircled{2} g(3) = 8 - 3 = \textcircled{5}$$

$$\textcircled{1} g(-4) = -4 + 4 = \textcircled{0}$$

$$\textcircled{1} g(0) = 0 + 4 = \textcircled{4}$$

$$\textcircled{1} g(1) = 1 + 4 = \textcircled{5}$$

$$\textcircled{2} g(100) = 8 - 100 = \textcircled{-92}$$