§2.3 GETTING INFORMATION FROM THE GRAPH OF A FUNCTION

ex. USE THE GRAPH $y = f(x)$ TO FIND

https://www.desmos.com/calculator/uhpaqhvulo

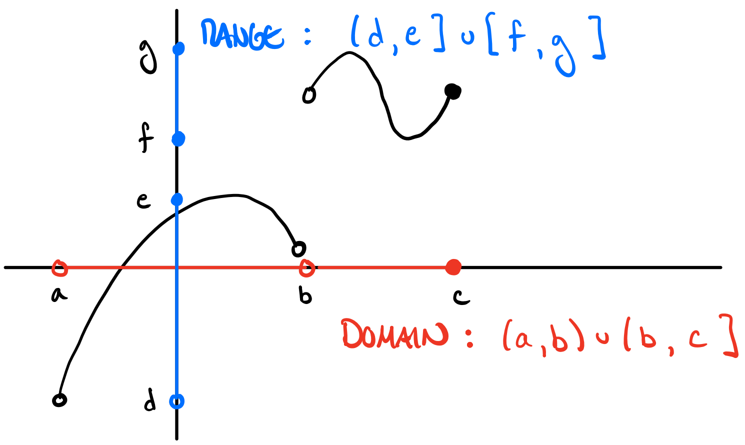
(a) $f(2)$, $f(4)$, $f(5)$
(b) THE NET CHANGE IN f FROM 2 TO 5.
(c) ALL VALUES OF x SUCH THAT $f(x) = -2$

THE VALUE $f(a)$ IS THE HEIGHT OF THE POINT ON THE GRAPH $y = f(x)$ ABOVE (POSITIVE) OR BELOW (NEGATIVE) THE POINT a ON THE x-AXIS

DOMAIN & RANGE: THE DOMAIN OF f IS THE SET OF ALL x-VALUES FOR WHICH f IS DEFINED. THE RANGE OF f IS THE SET OF ALL CORRESPONDING y-VALUES.

DOMAIN = SHADOW OF GRAPH ON x-AXIS

RANGE = SHADOW OF GRAPH ON y-AXIS



Two Graphs

ex. Let $f(x) = (x-1)(x-3)(x-5)$ & $g(x) = \frac{1}{2}(x-2)^2 - 1$

Use the graphs of f & g to approximate the values of x such that

(a) $f(x) = g(x)$

(b) $f(x) > g(x)$

(c) $f(x) \leq g(x)$

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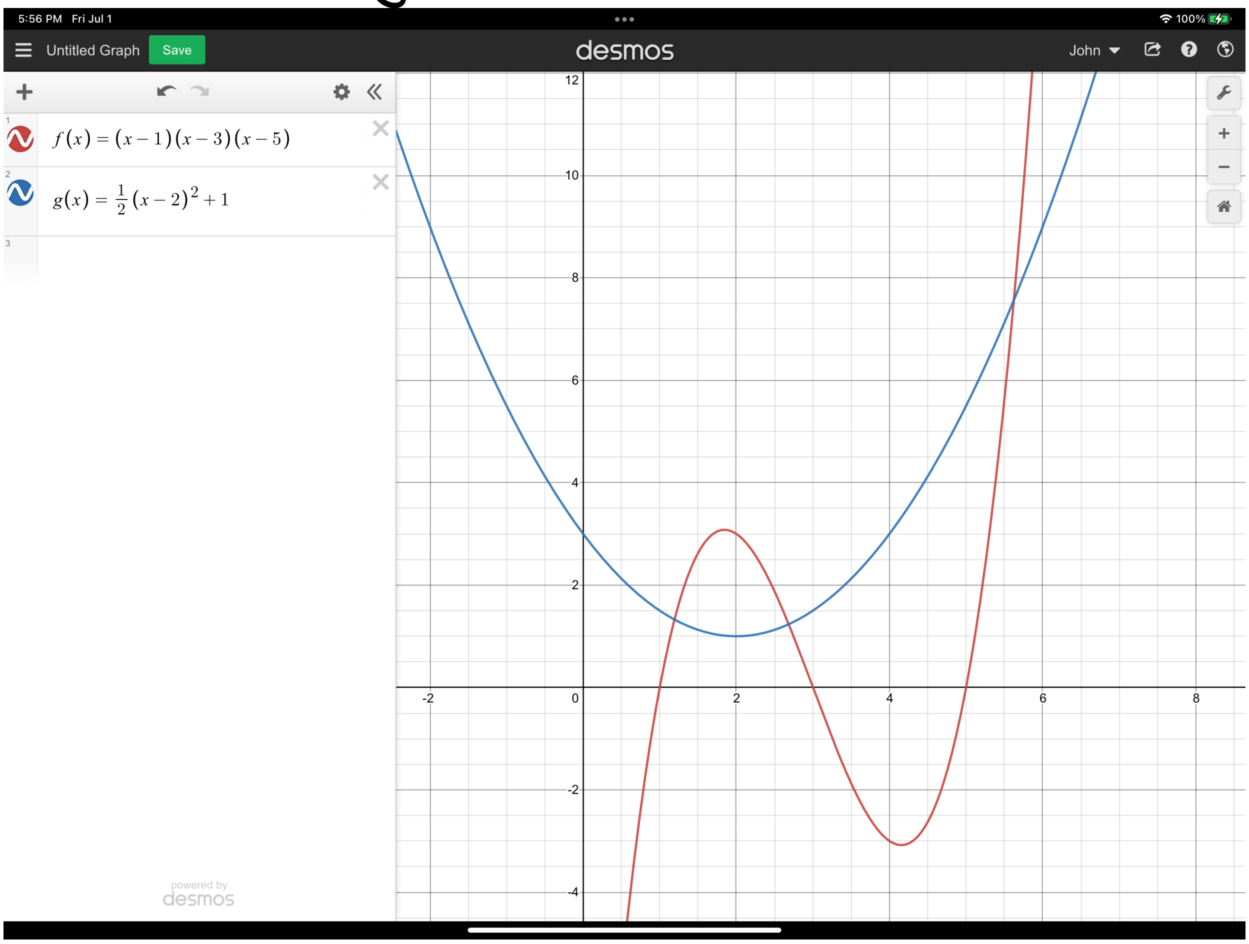
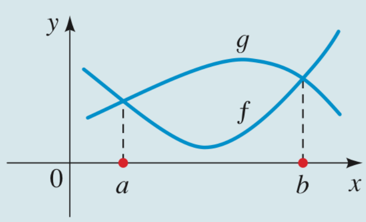


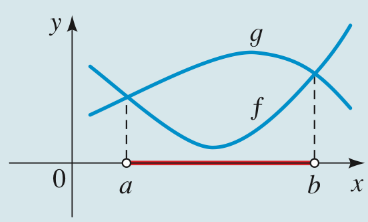
SOLVING EQUATIONS AND INEQUALITIES GRAPHICALLY

The **solution(s) of the equation** $f(x) = g(x)$ are the values of x where the graphs of f and g intersect.

The **solution(s) of the inequality** $f(x) < g(x)$ are the values of x where the graph of g is higher than the graph of f.



The solutions of $f(x) = g(x)$ are the values a and b.



The solution of $f(x) < g(x)$ is the interval (a, b).

INCREASING / DECREASING, MAX/MIN

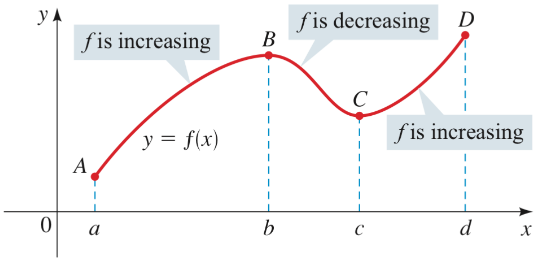


FIGURE 5 f is increasing on (a, b) and (c, d); f is decreasing on (b, c)

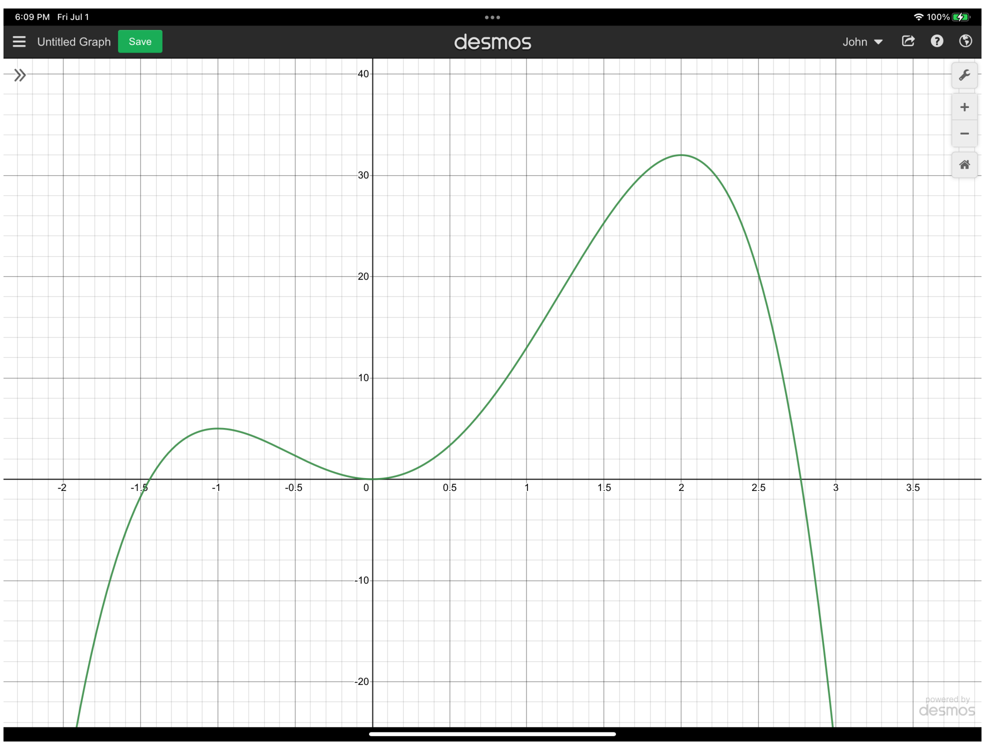
BY CONVENTION, INTERVALS OF INCR/DECR ARE OPEN INTERVALS WITH ENDPOINTS NOT INCLUDED.

ex. USE THE GRAPH OF $h(x) = 12x^2 + 4x^3 - 3x^4$ TO DETERMINE

(a) THE DOMAIN & RANGE OF h

(b) THE INTERVALS ON WHICH h IS INCREASING / DECREASING

(c) ALL LOCAL MAXIMUM VALUES & LOCAL MINIMUM VALUES OF h



https://www.desmos.com/calculator/uhpaqhvulo

LOCAL MAXIMA AND MINIMA OF A FUNCTION

1. The function value $f(a)$ is a **local maximum value** of f if

$$f(a) \geq f(x) \quad \text{when } x \text{ is near } a$$

(This means that $f(a) \geq f(x)$ for all x in some open interval containing a.) In this case we say that f has a **local maximum** at $x = a$.

2. The function value $f(a)$ is a **local minimum value** of f if

$$f(a) \leq f(x) \quad \text{when } x \text{ is near } a$$

(This means that $f(a) \leq f(x)$ for all x in some open interval containing a.) In this case we say that f has a **local minimum** at $x = a$.