For the function $f(x) = 2x^2 - 2x - 4$,

1. Construct but do not simplify the difference quotient for the function. (2 points)

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

2. State the vertex. (2 point)

$\left(\frac{-b}{2a}, f\left(\frac{-b}{2a}\right)\right) = \left(\frac{1}{2}, \frac{-9}{2}\right)$

3. State the equation of the axis of symmetry. (2 points)

$x = \frac{1}{2}$

4. Solve the quadratic equation. $2x^2 - 2x - 4 = 0$. (2 points)

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

$2(x-2)(x+1)=0$

$x = 2, -1$

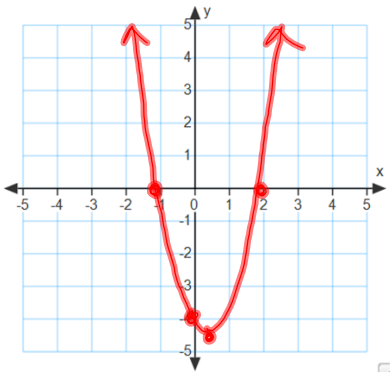
5. Determine the y-intercept for the function. (2 points)

$f(0) = -4$ $(0,-4)$

6. Determine the x-intercept(s) (if any). (2 points)

$(2,0)$ & $(-1,0)$

7. Graph the function. (3 points)

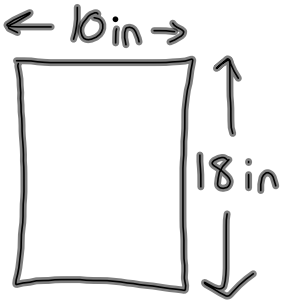


Bonus: State the equation of a function similar in shape to the greatest integer function, but which contains "steps" which are two units in length, the step $0 < x \leq 2$ has y-value 0, and the step $2 < x \leq 4$ has y-value 1.

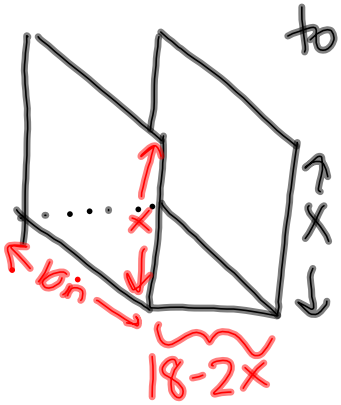
$$f(x) = \begin{cases} \left[\left[\frac{1}{2}x\right]\right], & x \notin \mathbb{Z} \\ \frac{1}{2}x - 1, & x \in \mathbb{Z} \end{cases}$$

24

43.



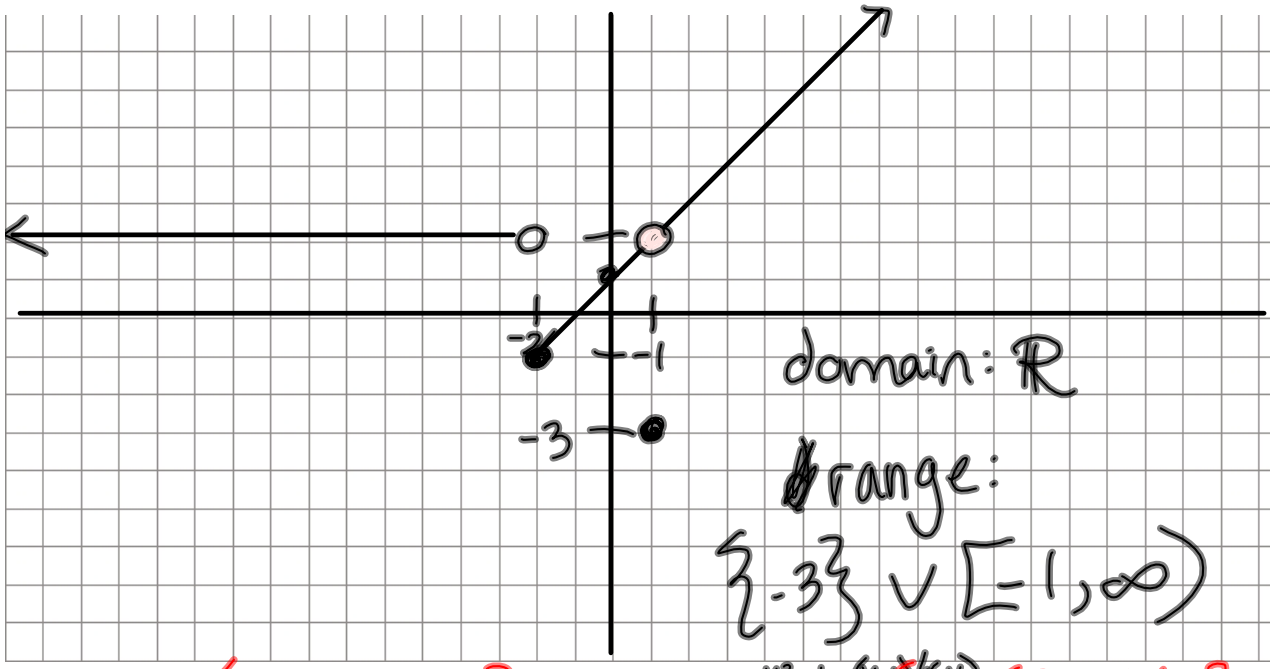
how tall to maximize volume?



$V(x) = 10x(18-2x)$

$V(x) = -20x^2 + 180x$

$\frac{-b}{2a} = \frac{-180}{2(-20)} = \frac{9}{2}$ in tall



8. $f(x)=\begin{cases}2, & x<-2\\ \frac{x^2-1}{x-1}, & x\geq -2,\ x\neq 1\\ -3, & x=1\end{cases}$ $\frac{x^2-1}{x-1}=\frac{(x-1)(x+1)}{x-1}=x+1$

$\begin{cases}2, & x<-2\\ x+1, & x\geq -2,\ x\neq 1\\ -3, & x=1\end{cases}$

15. $(4,-2)$ is on the graph of $y=f(x)$.
What point is on $y=3f(x)$?

$(4,-6)$

11. $f(x)=1-x^2$; $g(x)=\sqrt{x^2-4}$

a. $(g\circ f)(x)=\sqrt{(1-x^2)^2-4}$

b. $(g\circ f)(-2)=\sqrt{(1-(-2)^2)^2-4}$

$1-4$

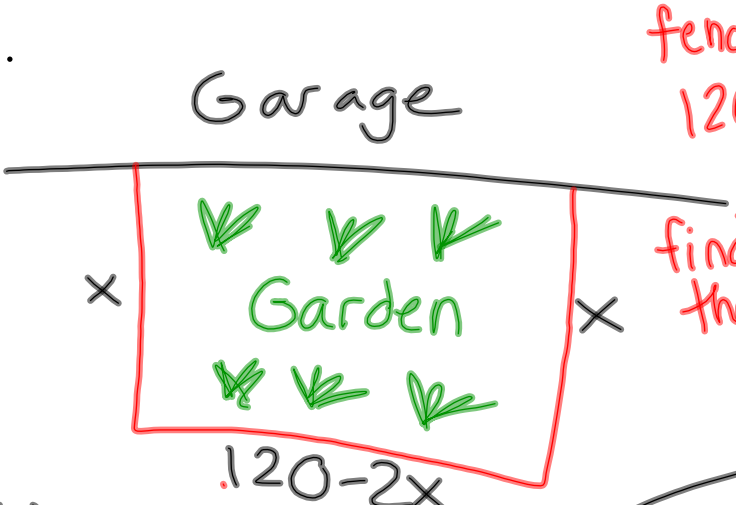
-3

$(-3)^2$

$9-4=5$

$=\sqrt{5}$

19.



fence is 120 ft

find dimensions that maximize area.

$A(x)=x(120-2x)$

$A(x)=-2x^2+120x$

$\frac{-b}{2a}=\frac{-120}{2(-2)}=30ft$

30 ft x 60 ft

20. Profit = Revenue − Cost

Cost : \$20

Revenue $R(x) = 10(10)t$

$P(t) = 100t - 20$

$P(8) = 100(8) - 20 = \boxed{\$780}$

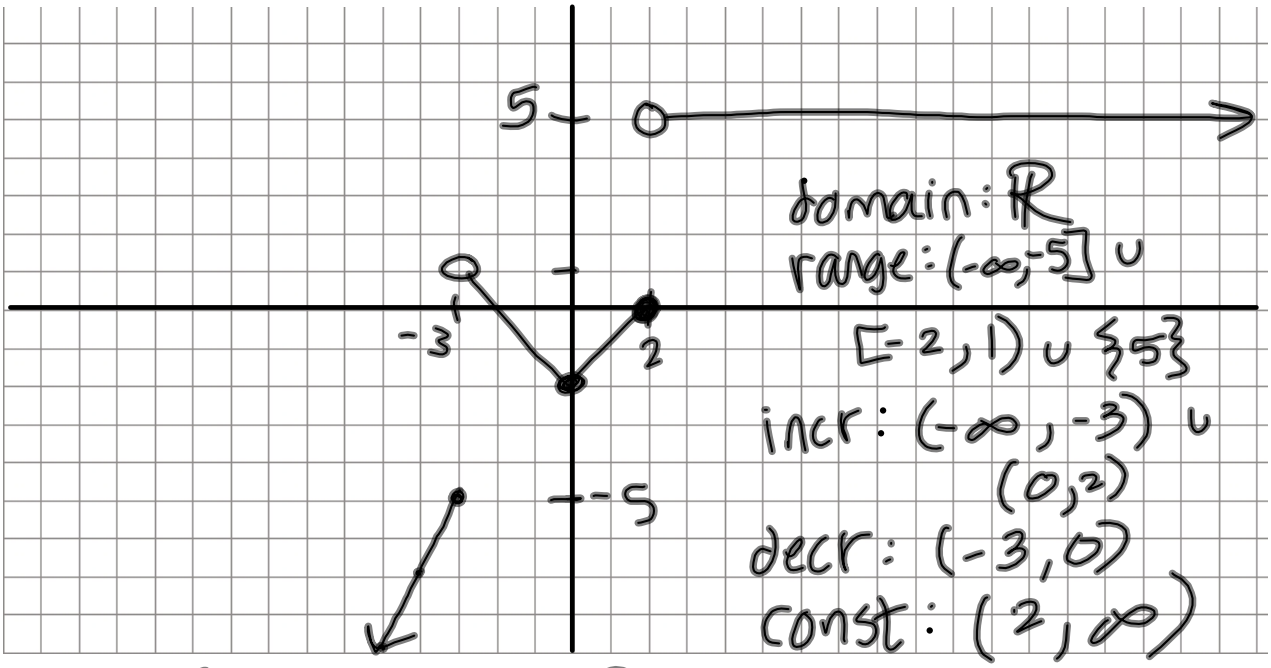
13. $f(-x) = \dfrac{(-x)^2}{(-x)-1} = \dfrac{x^2}{-x-1}$

neither even nor odd

$f(-x) = f(x)$ even $\quad f(x) = \dfrac{x^2}{x-1}$

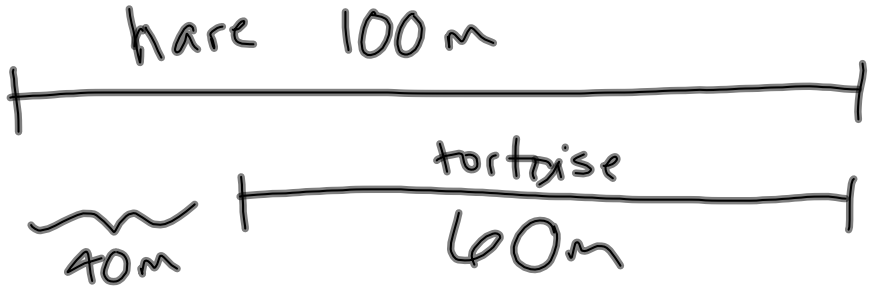
$f(-x) = -f(x)$ odd $\quad -f(x) = -\dfrac{x^2}{x-1}$

$\dfrac{x^2}{1-x}$



$$f(x)=\begin{cases}2x+1, & x\le -3\\ |x|-2, & -3<x\le 2\\ 5, & x>2\end{cases}$$

9.



tortoise can run 0.5 m/s

time for tortoise to reach finish line?

distance = rate · time

$60 = 0.5t$

$\frac{60}{0.5} = t = 120$ s

8. $f(x) = \frac{1}{x}$ $y = \frac{-3}{x-2} + 1$

Vertical stretch of 3

Velical flip

right 2

up 1

$y = f(x)$

$y = -3f(x)$

$y = -3f(x-2)+1$

6. $(\overset{x_0}{-2}, \overset{y_0}{1})$; $(7, -3)$

$m = \frac{\Delta y}{\Delta x} = \frac{-3-1}{7-(-2)} = \frac{-4}{9}$

$y - y_0 = m(x - x_0)$

$y - 1 = \frac{-4}{9}(x + (+2))$

$y = \frac{-4}{9}x - \frac{8}{9} + \frac{9}{9}$

$y = \frac{-4}{9}x + \frac{1}{9}$