HW: A22 pg. 209 # 16-25

12.3/12.4 Graphing in Standard Form and the Discriminant

Key Features (from last class)

AOS: $x = \frac{-b}{2a}$

vertex: $x = \frac{-b}{2a}$, then plug back into equation to get y

x-int: $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$

y-int: $(0, c)$

Ex #1 Identify the key features, graph, and tell if it has a maximum or minimum.

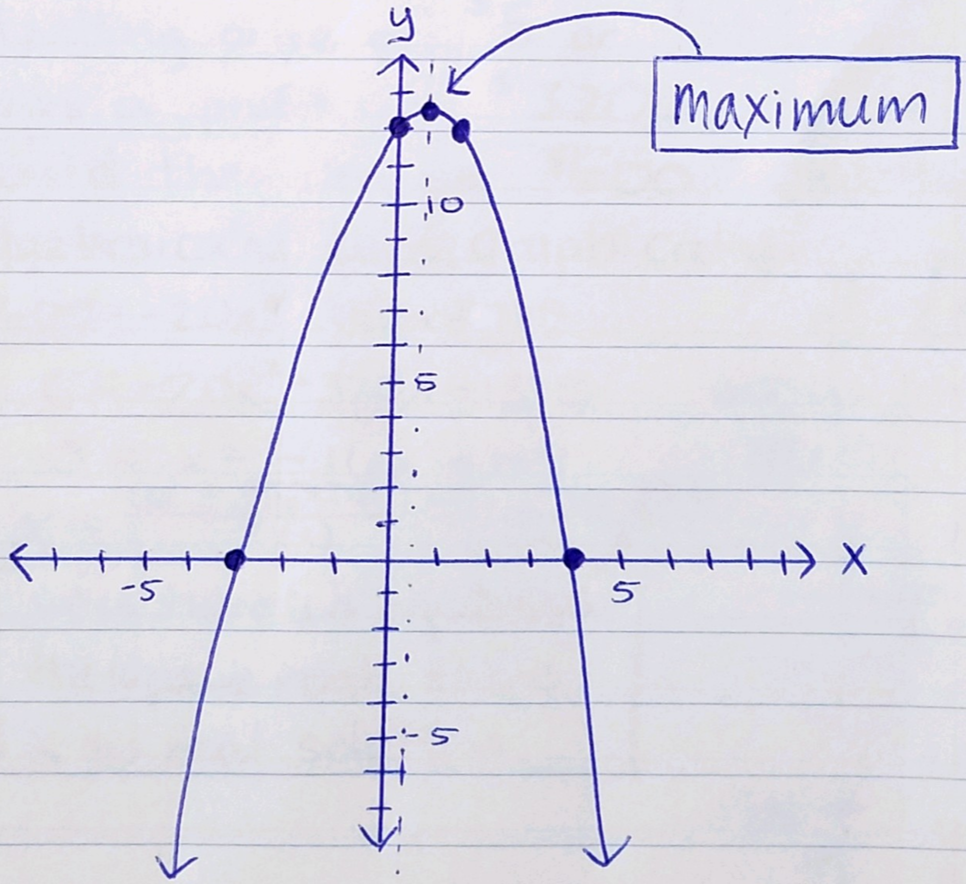
a) $f(x) = -x^2 + x + 12$

AOS: $x = 0.5$
vert: $(0.5, 12.25)$
x-int: -3 and 4
y-int: $(0, 12)$

$x = \frac{-1}{2(-1)} = \frac{1}{2} = 0.5$

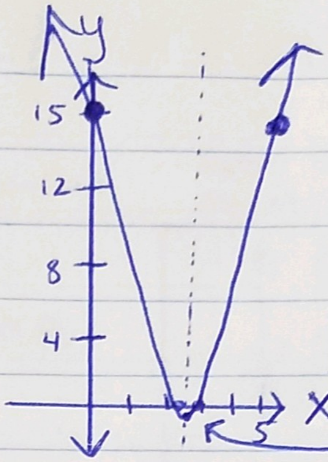
$y = -(0.5)^2 + (0.5) + 12 = 12.25$

$x = \frac{-1 \pm \sqrt{1^2-4(-1)(12)}}{2(-1)} = \frac{-1 \pm \sqrt{49}}{-2} = \frac{-1 \pm 7}{-2} < \begin{matrix} 4 \\ -3 \end{matrix}$



b) $g(x) = 2x^2 - 11x + 15$

AOS: $x = 2.75$
Vert: $(2.75, -0.125)$
x-int: 2.5 and 3
y-int: $(0, 15)$



minimum

Ex#2 $P(x) = -20x^2 + 320x - 780$ from last class

models the profit of selling candles for x dollars.

a) What selling price would give a profit of \$320?

$$\cancel{320} = -20x^2 + 320x - 780$$
$$\cancel{-320} \qquad\qquad\qquad -320$$
$$\frac{0}{-20} = \frac{-20x^2}{-20} + \frac{320x}{-20} - \frac{1100}{-20}$$
$$0 = x^2 - 16x + 55$$
$$x = \frac{16 \pm \sqrt{16^2 - 4(1)(55)}}{2(1)} = \frac{16 \pm \sqrt{36}}{2} < \begin{matrix} 5 \\ 11 \end{matrix}$$

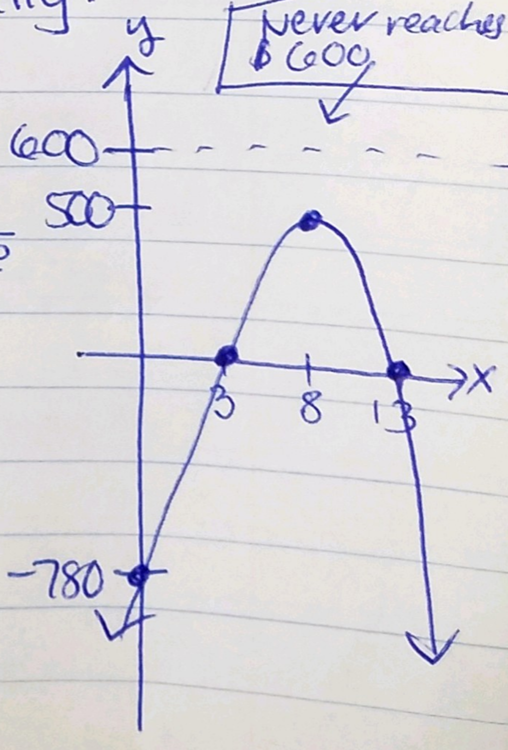
A selling price of \$5 or \$11 gives a profit of \$320.

b) Could they make \$600? Justify algebraically and graphically.

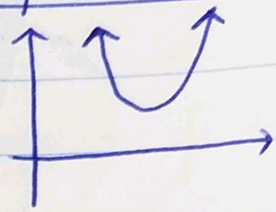
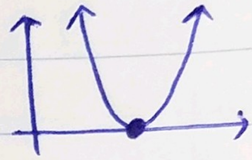
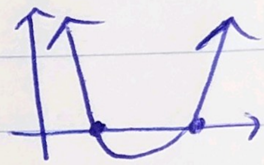
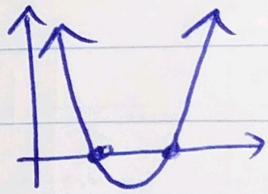
$$\cancel{600} = -20x^2 + 320x - 780$$
$$\cancel{-600} \qquad\qquad\qquad -600$$
$$\frac{0}{-20} = \frac{-20x^2}{-20} + \frac{320x}{-20} - \frac{1380}{-20}$$
$$0 = x^2 - 16x + 69$$
$$x = \frac{16 \pm \sqrt{16^2 - 4(1)(69)}}{2(1)} = \frac{16 \pm \sqrt{-20}}{2}$$

since there is a negative in the square root, there is no real solution.

Never reaches \$600



The Discriminant

b^2-4ac	solution types	# of x-int	What the graph might look like
<0 (negative)	2 imaginary	none	
$=0$	1 real & rational	1	
>0 & perfect square	2 real & rational	2	
>0 & not perfect square	2 real & irrational	2	

Ex #3 Determine the value of the discriminant, describe the types of solutions, and find the x-int.

a) $x^2-4x+1=0$

$\boxed{\text{2 real \& irrational solutions}}$

$b^2-4ac = 16-4 = \boxed{12}$

$X = \frac{4 \pm \sqrt{12}}{2}$ $\boxed{\approx 3.732 \text{ and } \approx 0.268}$

↑ exact ↑ approximations

b) $x^2-6x+15=0$

$b^2-4ac = (-6)^2-4(1)(15) = 36-60 = \boxed{-24}$

$\boxed{\text{2 imaginary solutions}}$

$\boxed{\text{no x-int}}$