1. a) $f(x) = -2(3x-12)^2 + 1$
$= -2(3(x-4))^2 + 1$
$= -2(9)(x-4)^2 + 1$
$= -18(x-4)^2 + 1$
$V(4, 1)$

b) $f(x) = -3|4-2x|$
$= -3|-2(x-2)|$
$= -3|-2| \cdot |x-2|$
$= -6|x-2|$
$V(2, 0)$

c) $f(x) = (6-2x)^2$
$= (-2(x-3))^2$
$= 4(x-3)^2$
$V(3, 0)$

2. 1) $V(-5,7)$ $P(2,0)$
$f(x) = a|x+5| + 7$
$0 = a|2+5| + 7$
$0 = a|7| + 7$
$-7 = 7a$
$-1 = a$
$f(x) = -|x+5| + 7$

a) $f(0) = -|0+5| + 7$
$= -|5| + 7$
$= -5 + 7$
$= 2$

b) $f(-3) = -|-3+5| + 7$
$= -|2| + 7$
$= -2 + 7$
$= 5$

c) $4 = -|x+5| + 7$
$-3 = -|x+5|$
$3 = |x+5|$
$3 = x+5$ $\quad -3 = x+5$
$-2 = x$ $\quad -8 = x$
$x = \{-8, -2\}$

d) $-|x+5| + 7 < 1$
$-|x+5| + 7 = 1$
$-|x+5| = -6$
$|x+5| = 6$
$x+5 = 6$ $\quad x+5 = -6$
$x = +1$ $\quad x = -11$

from graph: $f(x) < 1$
$x \in \ ]-\infty, -11[\cup]1, +\infty[$

2. 2) $V(3,-2)$ $P(7,1)$

$f(x) = a(x-3)^2 - 2$

$1 = a(7-3)^2 - 2$

$3 = a(4)^2$

$3 = 16a$

$\frac{3}{16} = a$

$f(x) = \frac{3}{16}(x-3)^2 - 2$

a) $f(0) = \frac{3}{16}(0-3)^2 - 2$

$= \frac{3}{16}(-3)^2 - 2$

$= \frac{3}{16}(9) - 2$

$= \frac{27}{16} - \frac{32}{16}$

$= \frac{-5}{16}$

b) $f(-3) = \frac{3}{16}(-3-3)^2 - 2$

$= \frac{3}{16}(-6)^2 - 2$

$= \frac{3}{16}(36) - 2$

$= \frac{27}{4} - \frac{8}{4}$

$= \frac{19}{4}$

c) $4 = \frac{3}{16}(x-3)^2 - 2$

$6 = \frac{3}{16}(x-3)^2$

$32 = (x-3)^2$

$\pm\sqrt{32} = x-3$

$3+\sqrt{32} = x$ or $x = 3-\sqrt{32}$

$3+4\sqrt{2} = x$ $\quad x = 3-4\sqrt{2}$

d) $\frac{3}{16}(x-3)^2 - 2 < 1$

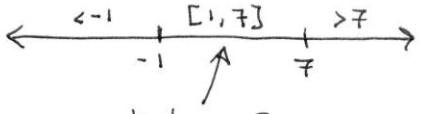
$\frac{3}{16}(x-3)^2 - 2 = 1$

$\frac{3}{16}(x-3)^2 = 3$

$(x-3)^2 = 16$

$x-3 = 4$ $\quad x-3 = -4$

$x = 7$ $\quad x = -1$



test $x = 3$

$\frac{3}{16}(3-3)^2 - 2 < 1$

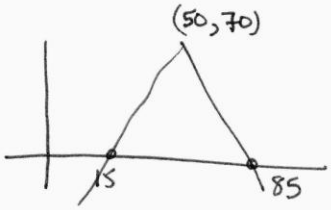
$0 - 2 < 1$

$-2 < 1$ True

$\therefore f(x) < 1$

$x \in]-1, 7[$

5. $P(x) = -|100 - 2x| + 70$



$f(x) = -|-2(x-50)| + 70$

$f(x) = -2|x-50| + 70$

a) $P = 0$

$0 = -|100 - 2x| + 70$

$-70 = -|100 - 2x|$

$70 = |100 - 2x|$

$100 - 2x = 70$ OR $100 - 2x = -70$

$30 = 2x$ OR $170 = 2x$

$15 = x$ OR $85 = x$

[15, 85] subscriptions

b) $x = 40$ $f(40) = -|100 - 2(40)| + 70$

$= -|100 - 80| + 70$

$= -|20| + 70$

$= -20 + 70$

$= 50$

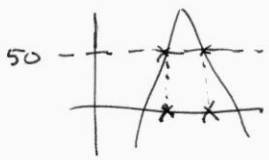
The profit is \$50

c) $f(x) \geq 50$

$50 = -|100 - 2x| + 70$

$-20 = -|100 - 2x|$

$20 = |100 - 2x|$



$20 = 100 - 2x$ or $-20 = 100 - 2x$

$2x = 80$ $2x = 120$

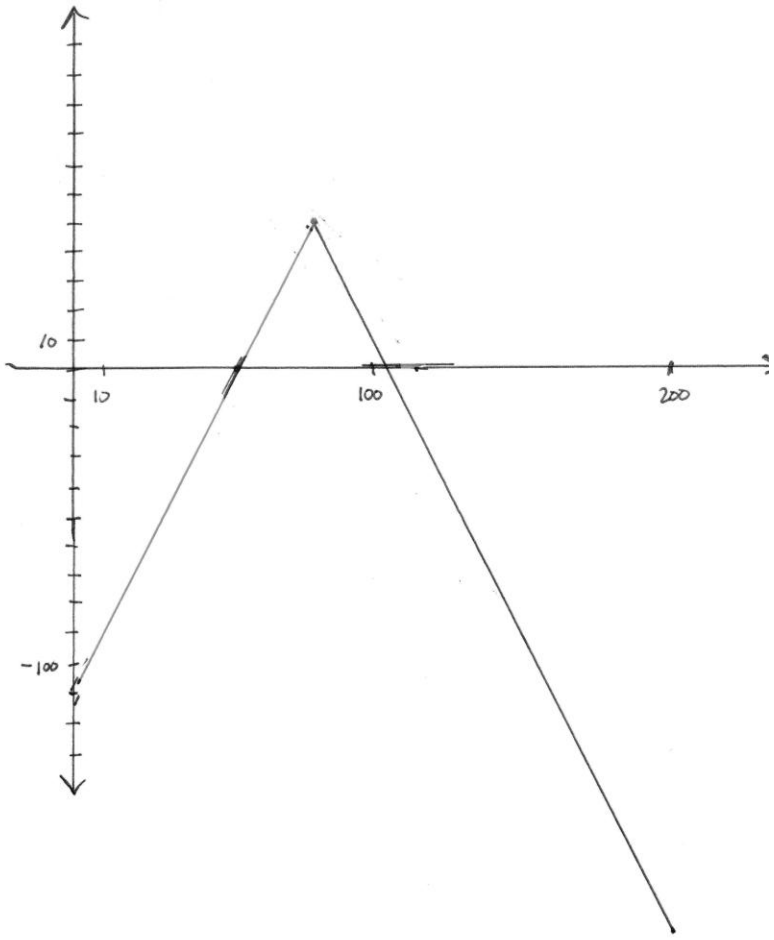
$x = 40$ $x = 60$

[40, 60] subscriptions

6. $P(n) = -|2n-160|+50$

$P(n) = -|2(n-80)|+50$

$P(n) = -2|n-80|+50$



a) $V(80, 50)$

$(0, -110)$

$0 = -2|n-80|+50$

$-50 = -2|n-80|$

$25 = |n-80|$

$n-80 = 25$ $\quad$ $n-80 = -25$

$n = 105$ $\quad$ $n = 55$

b) $x = 100$

$f(100) = -2|100-80|+50$

$= -2|20|+50$

$= -40+50$

$= 10$

\$10 profit

c) $40 = -2|x-80|+50$

$-10 = -2|x-80|$

$5 = |x-80|$

$x-80 = 5$ or $x-80 = -5$

$x = 85$ $\quad$ $x = 75$

75 or 85 magnets

d) $f(60) = -2|60-80|+50$

$= -2|-20|+50$

$= -2(20)+50$

$= -40+50$

$= 10$

\$10 profit

7.

$f(x) = -|x-4| + 3$

Vertex : $(4, 3)$

Axis of symmetry : $x = 4$

$f(x) \leq 2 :]-\infty, 3] \cup [5, +\infty[$

Zeros : $x = \{1, 7\}$

$2 = -|x-4| + 3$

$-1 = -|x-4|$

$1 = |x-4|$

$1 = x-4$ or $-1 = x-4$

$5 = x$ $\quad$ $3 = x$

$0 = -|x-4| + 3$

$-3 = -|x-4|$

$3 = |x-4|$

$3 = x-4$ or $-3 = x-4$

$7 = x$ $\quad$ $1 = x$

$g(x) = |2x+1| - 3$

$g(x) = |2(x+\frac{1}{2})| - 3$

$g(x) = 2|x+\frac{1}{2}| - 3$

Vertex : $(-\frac{1}{2}, -3)$

Axis of Symmetry : $x = -\frac{1}{2}$

$g(x) \leq 2 : [-3, 2]$

Zeros : $\{-2, 1\}$

$2 = |2x+1| - 3$

$5 = |2x+1|$

$5 = 2x+1$ $\quad$ $-5 = 2x+1$

$4 = 2x$ $\quad$ $-6 = 2x$

$2 = x$ $\quad$ $-3 = x$

$0 = |2x+1| - 3$

$3 = |2x+1|$

$2x+1 = 3$ $\quad$ $2x+1 = -3$

$2x = 2$ $\quad$ $2x = -4$

$x = 1$ $\quad$ $x = -2$

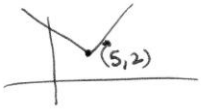
$h(x) = 3|x-5|+2$

Vertex : $(5,2)$

Axis of symmetry : $x = 5$

$h(x) \leq 2$: $x = 5$ (vertex)

Zeros : none



$j(x) = -4|2x-3|$

$j(x) = -4|2(x-3/2)|$

$j(x) = -8|x-3/2|$

Vertex: $(3/2, 0)$

Axis of symmetry : $x = 3/2$

$j(x) \leq 2$: $\mathbb{R}$ (whole function is ≤ 2)

Zeros : $x = 3/2$ (vertex)