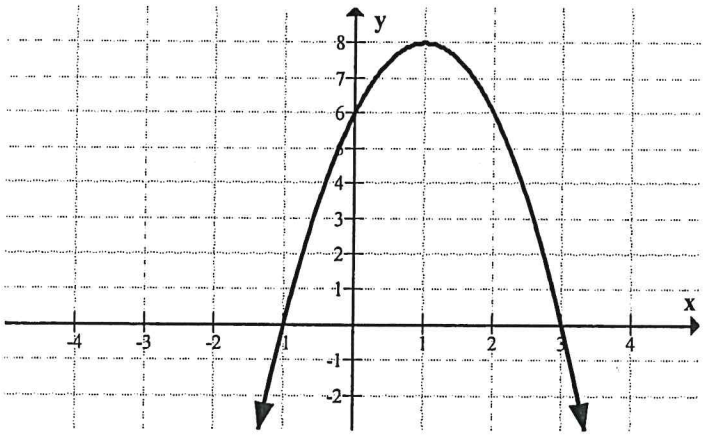
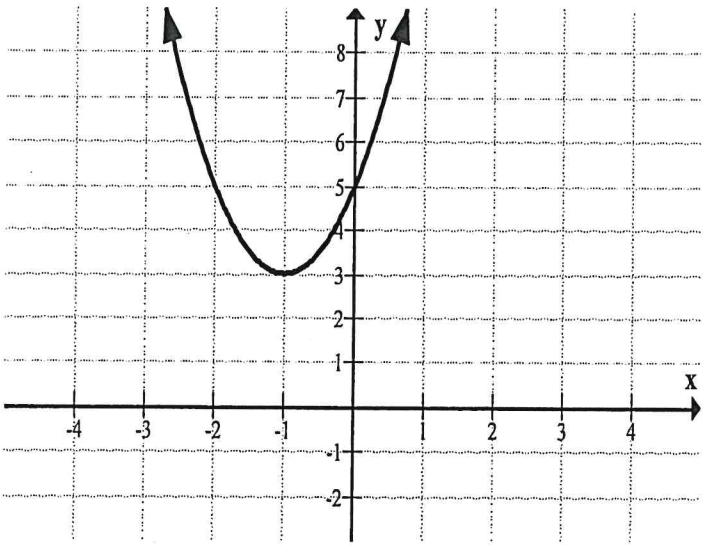
1) Identify all the key parts of the following parabolas:



Vertex	(1, 8)
Axis of Symmetry	x = 1
Optimal Value	y = 8
y-intercept	(0, 6)
x-intercepts	(1, 0) & (3, 0)
Direction of Opening	↓



Vertex	(-1, 3)
Axis of Symmetry	x = -1
Optimal Value	y = 3
y-intercept	(0, 5)
x-intercepts	NONE
Direction of Opening	↑

2) The following equations are all in vertex form: $y = a(x - \mathrm{h})^2 + k$. Complete the table.

Equation	Vertex	Step Pattern
$y = (x - 4)^2 + 8$	(4, 8)	1, 3, 5
$y = 5(x + 3)^2 + 4$	(-3, 4)	5, 15, 25
$y = 0.2(x + 10)^2 - 42$	(-10, -42)	0.2, 0.6, 1

3) The following equations are all in factored form: $y = a(x - s)(x - t)$. Complete the table.

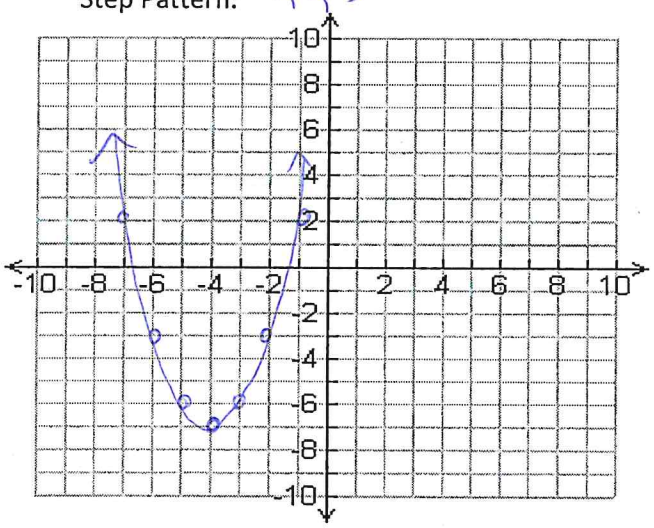
Equation	Zeros (x-intercepts)	Step Pattern
$y = (x + 5)(x - 5)$	(-5, 0) & (5, 0)	1, 3, 5
$y = 4(x + 2)(x + 1)$	(-2, 0) & (-1, 0)	4, 12, 20
$y = 0.11(x - 4)(x + 3)$	(4, 0) & (-3, 0)	0.11, 0.33, 0.55

4) Try and make a sketch of the following parabolas given the equation in vertex form:

a) $y = (x + 4)^2 - 7$

Vertex: (-4, -7)

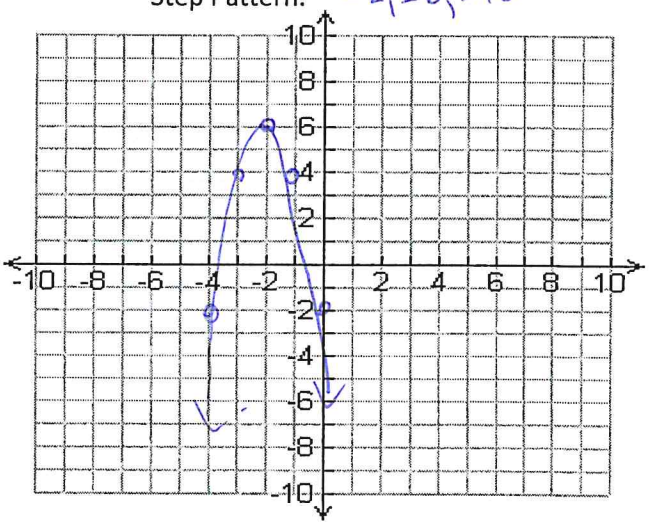
Step Pattern: 1, 3, 5



b) $y = -2(x + 2)^2 + 6$

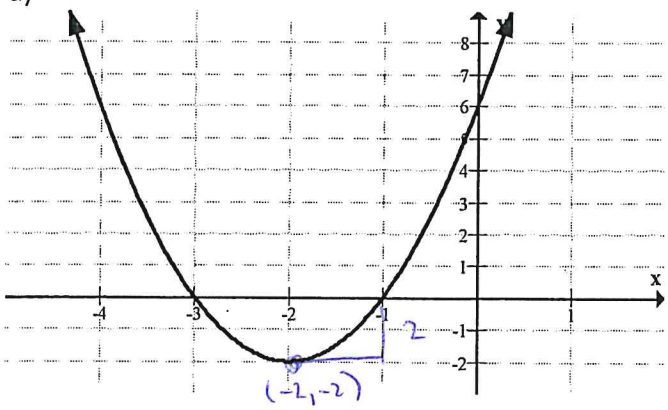
Vertex: (-2, 6)

Step Pattern: -2, -6, -10



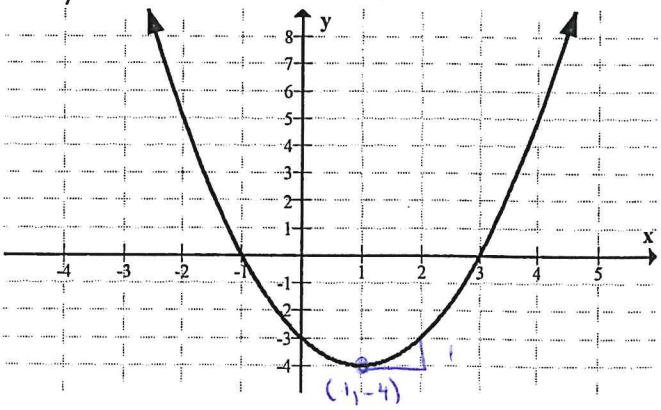
5) For the following graphs, write down the equation in **vertex form:** $y = a(x - \mathrm{h})^2 + k$

a)



Equation: $y =$ 2 $(x +$ 2 $)^2$ -2

b)

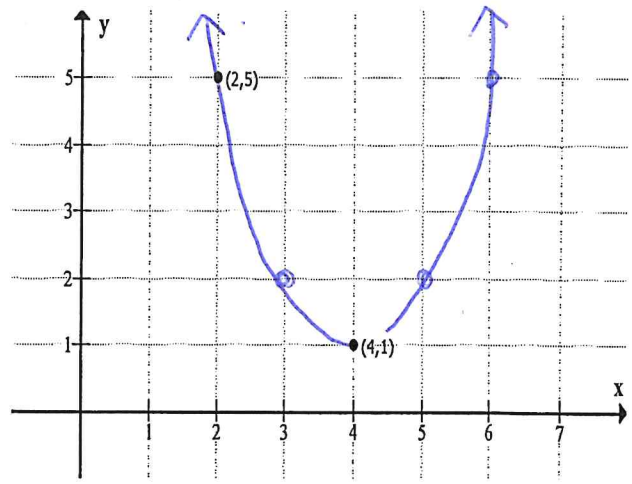


Equation: $y =$ 1 $(x -$ 1 $)^2$ -4

6) Find the equation of the parabola with a vertex of (4, 1) through the point (2, 5).

Vertex Form:	$y = a(x - \mathrm{h})^2 + k$
Sub in Vertex:	$y = a(x-4)^2 + 1$
Sub in Point:	$5 = a(2-4)^2 + 1$
Square and Solve:	$5 = 4a + 1$ $-1 \quad -1$ $4 = 4a$ $\boxed{1 = a}$

Sketch:



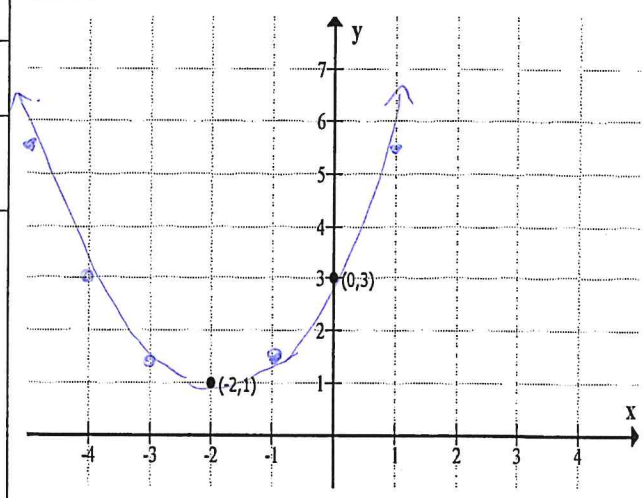
Equation:

Equation: $y =$ 1 $(x$ -4 $)^2$ +1

7) Find the equation of the parabola with a vertex of (-2, 1) through the point (0, 3).

Vertex Form:	$y = a(x - \mathrm{h})^2 + k$
Sub in Vertex:	$y = a(x+2)^2 + 1$
Sub in Point:	$3 = a(0+2)^2 + 1$
Square and Solve:	$3 = 4a + 1$ $-1 \quad -1$ $2 = 4a$ $0.5 = a$

Sketch:



Equation:

Equation: $y =$ 0.5 $(x$ + 2 $)^2$ +1

8) The school store is now selling gum!, and needs to decide on a price. Their goal is to maximize the amount of money they make per month.

You know this bit of market research:

"If you charge $2.00 per pack, you normally sell 50 every month. Every time you increase the price by $0.10, you sell 5 less packs of gum per month. Every time you decrease the price by $0.10, you sell 5 more packs of gum.

The question you need to ask is "What price should you charge per pack in order to make the most money possible?

a) Fill in the table below to find out (Mr. Smith has started it for you).

Price per pack of gum	Number of packs sold per month	Total money made per month (1st × 2nd columns)
$1.30	85	$110.50
$1.40	80	$112
$1.50	75	$112.50
$1.60	70	$112
$1.70	65	$110.50
$1.80	60	$108
$1.90	55	1.90 x 55 = $104.50
$2.00	50	2 x 50 = $100
$2.10	45	2.10 x 45 = $94.50
$2.20	40	$88
$2.30	35	$80.50
$2.40	30	$72

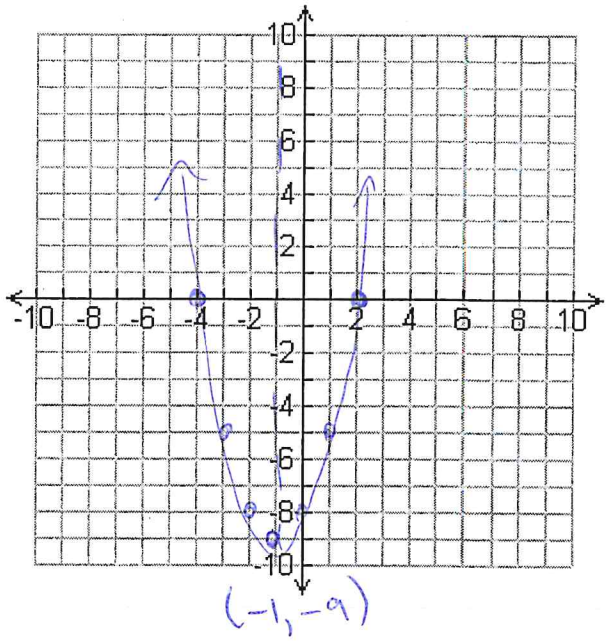
b) How much should you charge per pack to maximize how much money is made?

$1.50 per pack.

9) Sketch the following parabolas (in factored form) on the grids provided. Find the axis of symmetry, and vertex like we did in class, then use the step pattern to complete your sketch. Also, for each function, complete the table. ⑤ each.

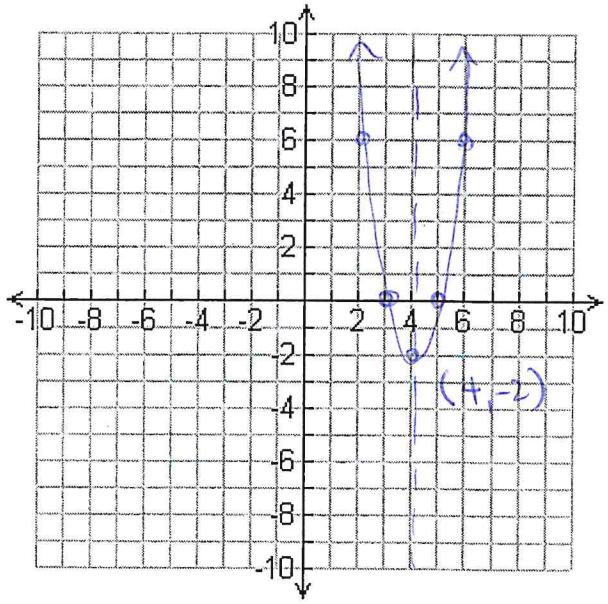
a) $y = (x - 2)(x + 4)$

$y = (x - 2)(x + 4)$
Zeros: $(2, 0)$ & $(-4, 0)$
Axis of Symmetry: $x = -1$
Find the vertex: $y = (-1-2)(-1+4)$ $= (-3)(3)$ $= -9$



b) $y = 2(x - 3)(x - 5)$

$y = 2(x - 3)(x - 5)$
Zeros: $(3, 0)$ & $(5, 0)$
Axis of Symmetry: $x = 4$
Find the vertex: $y = 2(4-3)(4-5)$ $= 2(1)(-1)$ $= -2$



10) Expand the following expressions by using the distributive law (FOIL), or an area model.

a) $(x+1)(x+5)$

$= x^2 + 5x + 1x + 5$

$= x^2 + 6x + 5$

b) $(x+7)(x+5)$

	x	$+7$
x	x^2	$7x$
$+5$	$5x$	35

$= x^2 + 12x + 35$

c) $(x+8)(x+2)$

$= x^2 + 2x + 8x + 16$

$= x^2 + 10x + 16$

d) $(x-5)(x+3)$

	x	-5
x	x^2	$-5x$
$+3$	$3x$	-15

$= x^2 - 2x - 15$

e) $(x+3)^2 + 5$

$= (x+3)(x+3) + 5$

$= x^2 + 3x + 3x + 9 + 5$

$= x^2 + 6x + 14$

f) $(x-4)^2 + 10$

$= (x-4)(x-4) + 10$

$= x^2 - 4x - 4x + 16 + 10$

$= x^2 - 8x + 26$

11) Expand the following 2 quadratic relations to convert them into standard form. A graph has been provided so that you can check your answer.

a) Vertex Form:

$y = (x-1)^2 - 4$

$= (x-1)(x-1) - 4$

$= x^2 - 1x - 1x + 1 - 4$

$= x^2 - 2x - 3$

b) Factored Form:

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

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

$= x^2 - 2x - 3$

Sketch: