
Math 2
• Quiz Friday
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Math II – Notes --- 5.1.2 –Designing Parabolas

VOCABULARY

Quadratic function in standard form ax^2+bx+c

Parabola – Shape of a quadratic graph (hump or crater)

Vertex of a parabola
halfway between the x-intercepts

Axis of symmetry of a parabola
divides the parabola in half (the x-coordinate of the vertex)

Factored Form
$k(x-a)(x-b)$
↑ gcf ↑ x-int ↑ x-int

General Rules

+ ax^2 → parabola opens up ∪

– ax^2 → parabola opens down ∩

Example 1: ***Finding X-intercepts and Vertex***

Consider the function: $f(x) = x(x - 200)$

- The x-intercept is the value of X when f(x) = 0.
  y = 0

  Therefore, $x(x - 200) = 0$

  $x = 0$ and $x - 200 = 0$
  $+200 \quad +200$
  $x = 200$

- We know that vertex lies directly between the two X-intercepts, so the x-value of the vertex (also known as the minimum) is 100.

- Y-Value of vertex: $X(X-200) = 100(100-200)$
  (X: 100, 100)
  $100(-100) = -10{,}000$ ← y-coord.

- Vertex coordinates:
  (100, -10,000)

Practice Problems:

Find the x-intercepts and the vertex

1. $f(x) = (x - 30)(x + 12)$

X-int: $x - 30 = 0$ $\quad x + 12 = 0$

$+30 \quad +30 \qquad -12 \quad -12$

$x = 30 \qquad x = -12$

Vertex: 42; -12, 9, 30; 21, 21

9 ↓ x-coordinate

$(x - 30)(x + 12)$

$9 \qquad 9$

$(9 - 30)(9 + 12)$

$(-21)(21) = -441$

Vertex: $(9, -441)$

2. $f(x) = (3x - 15)(5x + 20)$

X-int: $3x - 15 = 0$ $\quad 5x + 20 = 0$

$+15 \quad +15 \qquad -20 \quad -20$

$\frac{3x}{3} = \frac{15}{3} \qquad \frac{5x}{5} = \frac{-20}{5}$

$x = 5 \qquad x = -4$

Vertex: 9; -4, .5, 5; -4.5

.5 ↓ x-coordinate

$(3x - 15)(5x + 20)$

$.5 \qquad .5$

$(3(.5) - 15)(5(.5) + 20)$

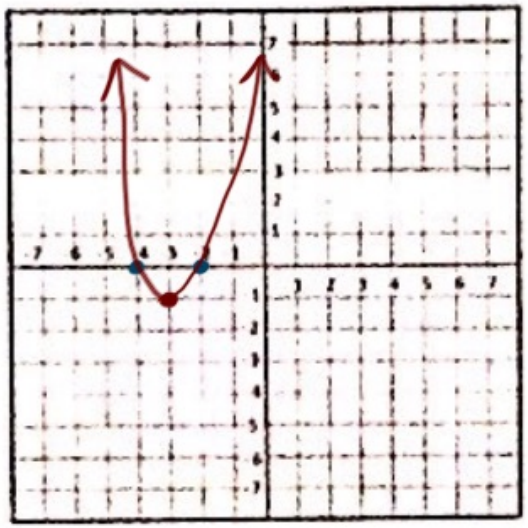
$(-13.5)(22.5) = -303.75$

y-coordinate

Vertex: $(.5, -303.75)$

Example 2: ***Finding other Pertinent Information***

Consider the function: $f(x) = (x + 4)(x + 2)$



What are the x-intercepts?

$x+4=0$ $\quad -4 \quad -4$ $\quad x=-4$

$x+2=0$ $\quad -2 \quad -2$ $\quad x=-2$

Vertex:

$(-3,-1)$

$(x+4)(x+2)$

$-3 \quad -3$

$(-3+4)(-3+2)$

$(1)(-1)=-1$

Axis of Symmetry:

$x=-3$

Is the vertex a max or a min?

min

Does the graph open up or down?

up

What is the y-intercept? $x=0$

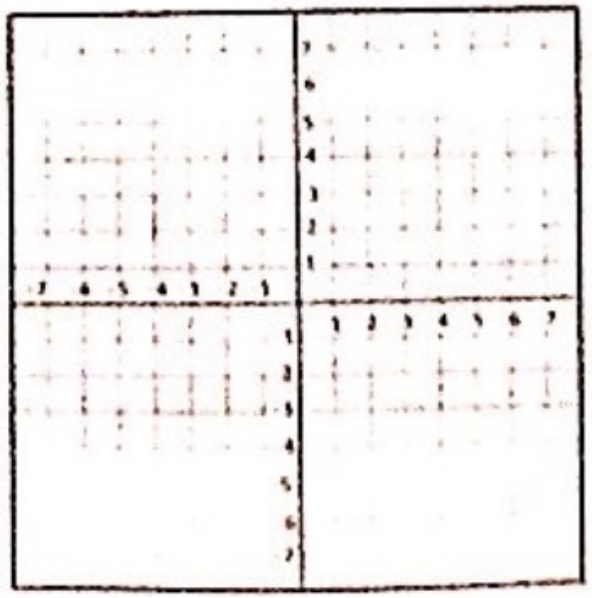
$y=(0+4)(0+2)$

$(4)(2)=8$

y-int: $(0,8)$

Example 3: ***Finding Pertinent Information from Standard Form***

Consider the function: $f(x) = x^2 + 6x + 8$



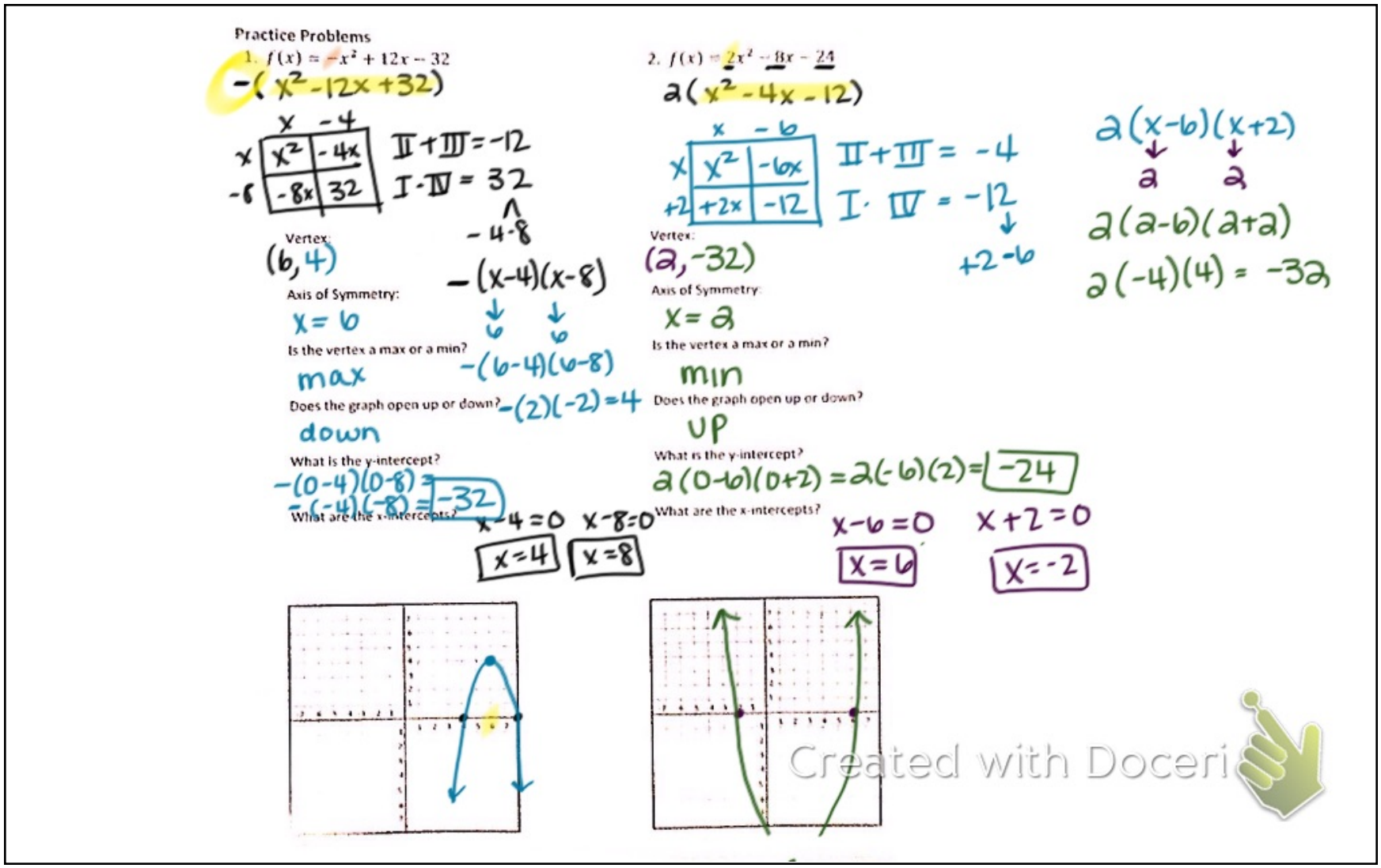
① Factor!

	x	$+4$
x	x^2	$+4x$
$+2$	$+2x$	8

II + III = 6

I · IV = 8 → 8 1, +4 +2

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


Practice Problems
1. $f(x) = -x^2 + 12x - 32$
$-(x^2 - 12x + 32)$
x -4
x | x^2 | -4x
-8 | -8x | 32
II + III = -12
I - IV = 32
-4 -8
Vertex:
(6, 4)
$-(x-4)(x-8)$
Axis of Symmetry:
x = 6
Is the vertex a max or a min?
max
$-(6-4)(6-8)$
$-(2)(-2) = 4$
Does the graph open up or down?
down
What is the y-intercept?
$-(0-4)(0-8) = -(-4)(-8) = -32$
What are the x-intercepts?
$x-4=0$ $x-8=0$
x = 4 x = 8
2. $f(x) = 2x^2 - 8x - 24$
$2(x^2 - 4x - 12)$
x -6
x | x^2 | -6x
+2 | +2x | -12
II + III = -4
I · IV = -12
+2 -6
Vertex:
(2, -32)
Axis of Symmetry:
x = 2
Is the vertex a max or a min?
min
Does the graph open up or down?
up
What is the y-intercept?
$2(0-6)(0+2) = 2(-6)(2) = -24$
What are the x-intercepts?
$x-6=0$ $x+2=0$
x = 6 x = -2
$2(x-6)(x+2)$
a a
$2(2-6)(2+2)$
$2(-4)(4) = -32$
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