

Factor each of the following expressions:

1) $64n^2 - 169$
 $(8n+13)(8n-13)$

2) $169n^2 - 4$
 $(13n+2)(13n-2)$

3) $b^2 - 18b + 81$
 $(b-9)^2$

4) $4x^2 + 12x + 9$
 $(2x+3)^2$

5) $b^2 + 3b - 70$
 $(b+10)(b-7)$

6) $x^2 - 12x + 27$
 $(x-9)(x-3)$

7) $3k^2 - 12k + 12$
 $3k^2 - 6k - 6k + 12$
 $3k(k-2) - 6(k-2)$
 $(3k-6)(k-2)$ or $3(k-2)(k-2)$
 $3(k-2)^2$

8) $2b^2 - b - 15$
 $2b^2 - 6b + 5b - 15$
 $2b(b-3) + 5(b-3)$
 $(2b+5)(b-3)$

~~$\begin{array}{r} 36 \\ -6 \quad -6 \\ \hline -12 \end{array}$~~

~~$\begin{array}{r} -30 \\ -6 \quad 5 \\ \hline -1 \end{array}$~~

Solve each of the following equations:

9) $x^2 - 12x = -36$
 $x^2 - 12x + 36 = 0$
 $(x-6)(x-6) = 0$
 $x-6 = 0$ $x = 6$

10) $p^2 + 16 = 10p$
 $p^2 - 10p + 16 = 0$
 $(p-8)(p-2) = 0$
 $p = 8$ $p = 2$

11) $7n^2 + 8 = 505$
 $7n^2 = 497$
 $\frac{7n^2}{7} = \frac{497}{7}$
 $n^2 = 71$ $n = \pm \sqrt{71}$

12) $5n^2 - 4 = -75$
 $5n^2 = -71$
 $\sqrt{n^2} = \sqrt{-14.2}$
No real roots

13) $x^2 + 16x + 51 = -9$
 $x^2 + 16x + 60 = 0$
 $(x+10)(x+6) = 0$
 $x = -10$ $x = -6$

14) $n^2 - 2n - 33 = -10$
 $n^2 - 2n + 1 = 23 + 1$
 $(n-1)^2 = 24$
 $n-1 = \pm \sqrt{24}$
 $n-1 = \pm 2\sqrt{6}$
 $n = 1 \pm 2\sqrt{6}$

15) $4x^2 - 4x = -11$ $4x^2 - 4x + 11 = 0$ $a=4$ $b=-4$ $c=11$
 $\frac{4 \pm \sqrt{(-4)^2 - 4(4)(11)}}{2(4)} = \frac{4 \pm \sqrt{-160}}{8}$ No real roots

16) $4a^2 - 100 = 0$
 $4a^2 = 100$
 $a^2 = 25$
 $a = \pm 5$

Convert the following equations to Vertex Form:

17) $y = x^2 - 8x + 15$
 vertex: $(4, -1)$
 $a = 1$
 $\frac{-b}{2a} = \frac{8}{2} = 4$
 $y = 4^2 - 8(4) + 15$
 $y = 16 - 32 + 15$
 $y = -16 + 15$
 $y = -1$
 $y = 1(x-4)^2 - 1$

18) $y = -2x^2 + 16x - 36$
 vertex: $(4, -4)$
 $\frac{-b}{2a} = \frac{-16}{2(-2)} = \frac{-16}{-4} = 4$
 $y = -2(4)^2 + 16(4) - 36$
 $y = -32 + 64 - 36 = 32 - 36 = -4$
 $a = -2$
 $y = -2(x-4)^2 - 4$

Convert the following equations to Standard Form:

19) $y = (x+2)^2 + 4$
 $y = (x+2)(x+2) + 4$
 $y = x^2 + 4x + 4 + 4$
 $y = x^2 + 4x + 8$

20) $y = 2(x+1)^2 + 4$
 $y = 2(x+1)(x+1) + 4$
 $y = 2(x^2 + 2x + 1) + 4$
 $y = 2x^2 + 4x + 2 + 4$
 $y = 2x^2 + 4x + 6$

21) Write the quadratic equation of parabola with the following information:

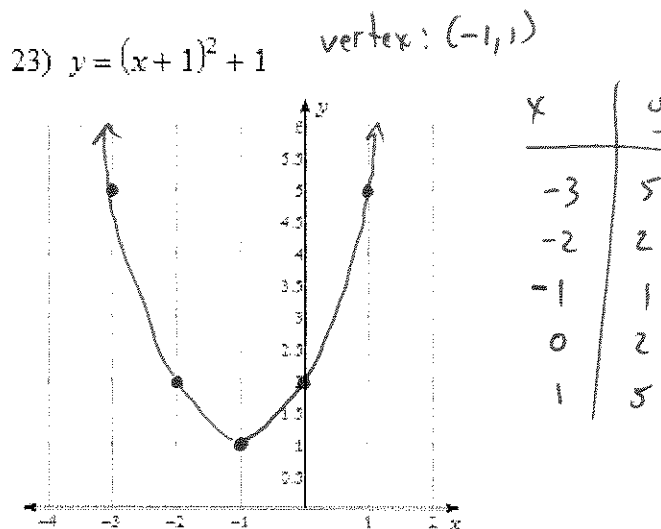
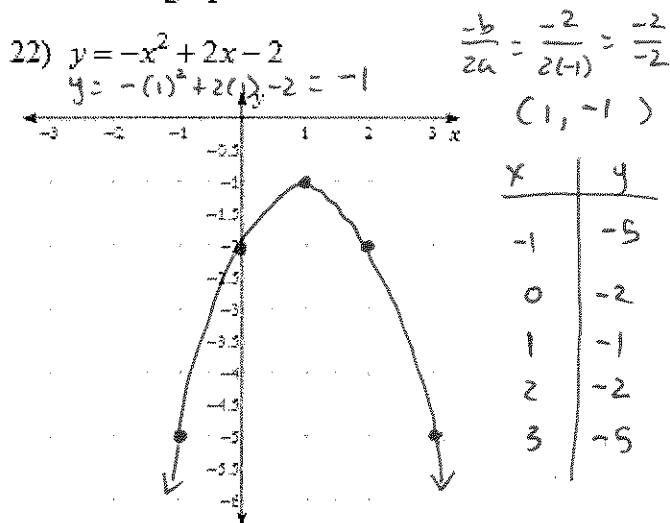
Vertex $(1, 3)$ passing through $(4, 8)$

$y = a(x-h)^2 + k$
 $y = a(x-1)^2 + 3$
 $8 = a(4-1)^2 + 3$

$8 = a(3)^2 + 3$
 $5 = \frac{9a}{9}$
 $a = 5/9$

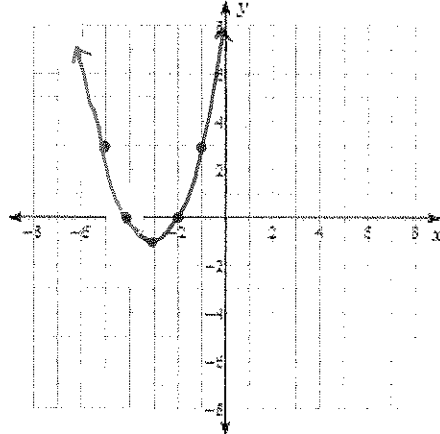
$y = \frac{5}{9}(x-1)^2 + 3$

Sketch the graph of each function.



x	y
-5	3
-4	0
-3	-1
-2	0
-1	3

24) $f(x) = (x + 4)(x + 2)$



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

$x+4 = 0$

$x = -4$

$x+2 = 0$

$x = -2$

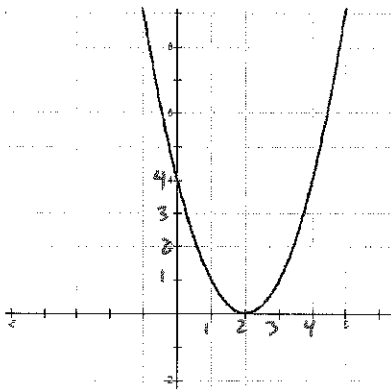
roots

$\frac{-4 + -2}{2} = \frac{-6}{2} = -3$ y-root vertex

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

$1 \cdot -1 = -1$ y-root vertex

25) Identify the listed characteristics of the following graph:



D: $(-\infty, \infty)$

R: $[0, \infty)$

Interval of Increase: $(2, \infty)$

Interval of Decrease: $(-\infty, 2)$

Vertex: $(2, 0)$ Axis of Symmetry: $x = 2$

Max or Min? Min at 0 when x is 2

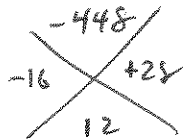
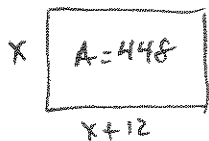
End Behavior: As $x \rightarrow -\infty$, $y \rightarrow \infty$ As $x \rightarrow \infty$, $y \rightarrow \infty$

x-intercept: $(2, 0)$ y-intercept: $(0, 4)$

26) Identify the transformations for the following quadratic functions in the chart.

Equation	Horizontal Shift	Vertical Shift	Reflection
$f(x) = (x - 6)^2 + 2$	Right 6	Up 2	No
$f(x) = -2(x + 1)^2 + 2$	Left 1	Up 2	Yes
$f(x) = 4x^2 + 10$	None	Up 10	No
$f(x) = -\frac{1}{2}(x + 3)^2 - 4$	Left 3	Down 4	Yes
$f(x) = -\frac{2}{5}(x - 5)^2 + 1$	Right 5	Up 1	Yes

27) The length of a rectangular plot is 12 yards more than its width. If the area of the land is 448 square yards, find the dimensions of the plot.



$$x(x+12) = 448$$

$$x^2 + 12x = 448$$

$$x^2 + 12x - 448 = 0$$

$$(x-16)(x+28) = 0$$

$$x = 16 \quad x = 28$$

$$16 \times 28$$

28) Jordan is hitting baseballs. He tosses the ball 5 ft high in front of him and then hits the ball. The ball leaves the bat with an initial velocity of 50 ft/sec. (hint: use $h(t) = -16t^2 + v_0t + h_0$)
Equation: $h(t) = -16t^2 + 50t + 5$

- How high is the ball 3 seconds after it has been hit? 11 ft
- How long does an outfielder have to react until the ball hits the ground? 3.22 seconds
- What is the maximum height of the baseball? 44.06 ft
- During what interval is the ball above 26 feet high? (1.5, 2.63)

a) $h(3) = -16(3)^2 + 50(3) + 5 = 11 \text{ feet}$

b) $0 = -16t^2 + 50t + 5$

$a = -16$

$b = 50$

$c = 5$

$$\frac{-50 \pm \sqrt{50^2 - 4(-16)(5)}}{2(-16)}$$

$$\frac{-50 \pm \sqrt{2820}}{-32}$$

c) $\frac{-b}{2a}$

$$\frac{-50}{2(-16)} = \frac{-50}{-32} = 1.56$$

$$h(1.56) = -16(1.56)^2 + 50(1.56) + 5$$

$$h(1.56) = 44.06$$

d) $26 = -16t^2 + 50t + 5$

$$0 = -16t^2 + 50t - 21$$

$$a = -16 \quad b = 50 \quad c = -21$$

$$\frac{-50 \pm \sqrt{50^2 - 4(-16)(-21)}}{2(-16)}$$

$$\frac{-50 \pm \sqrt{1156}}{-32}$$

$$\frac{-50 \pm 34}{-32}$$

$$\frac{-50 + 34}{-32} = .5$$

$$\frac{-50 - 34}{-32} = 2.63$$

29) On Tuesday, May 10, 2005, 17 year-old Adi Alifuddin Hussin won the boys' shot-putt gold medal for the fourth consecutive year. His winning throw was 16.43 meters. A shot-putter throws a ball at an inclination of 45° to the horizontal. This can be modeled by $h = -0.01x^2 + 1.06x + 0.02$ where h is the approximate height of a ball thrown by a shot-putter as it travels a distance of x meters horizontally.

What would be the height of the ball if it travels 80 meters? $x=80$ find h

$$h = -0.01(80)^2 + 1.06(80) + 0.02 = 20.82 \text{ m}$$

30) At a baseball game, workers toss T-shirts to spectators in the stands out of a slingshot. The height of a T-shirt is modeled by the function $h(t) = -5t^2 + 20t + 1$ where $h(t)$ is height in meters and t is the time in seconds after the toss.

- What is the maximum height of the T-shirt if it is not caught? 21 m
- How much time does it take the T-shirt to reach that maximum height? 2 sec

a) $\frac{-b}{2a} = \frac{-20}{2(-5)} = \frac{-20}{-10} = 2$

$$h(2) = -5(2)^2 + 20(2) + 1 = 21$$

$$(2, 21)$$