

Graph each of the following equations. BE SURE TO LABEL 5 POINTS, THE AXIS OF SYMMETRY, THE VERTEX AND THE X-INTERCEPTS.

1.  $f(x) = -5x^2 - 40x - 80$

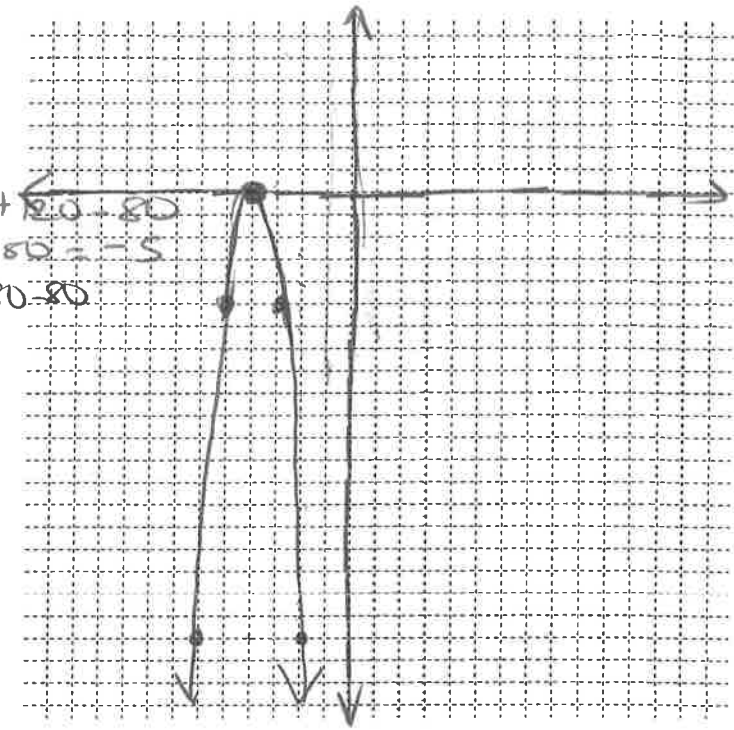
axis of symmetry:  $x = -4$

vertex:  $(-4, 0)$

$$x = \frac{-(-40)}{2(-5)}$$

$$= \frac{40}{-10} = -4$$

x	y
-3	$-5(9) + 20 - 80$
-2	$-45 - 80 = -125$
	$-20 + 80 - 80$
	$= -20$



$$f(-4) = -5(-4)^2 - 40(-4) - 80$$

$$= -5(16) + 160 - 80$$

$$= -80 + 160 - 80$$

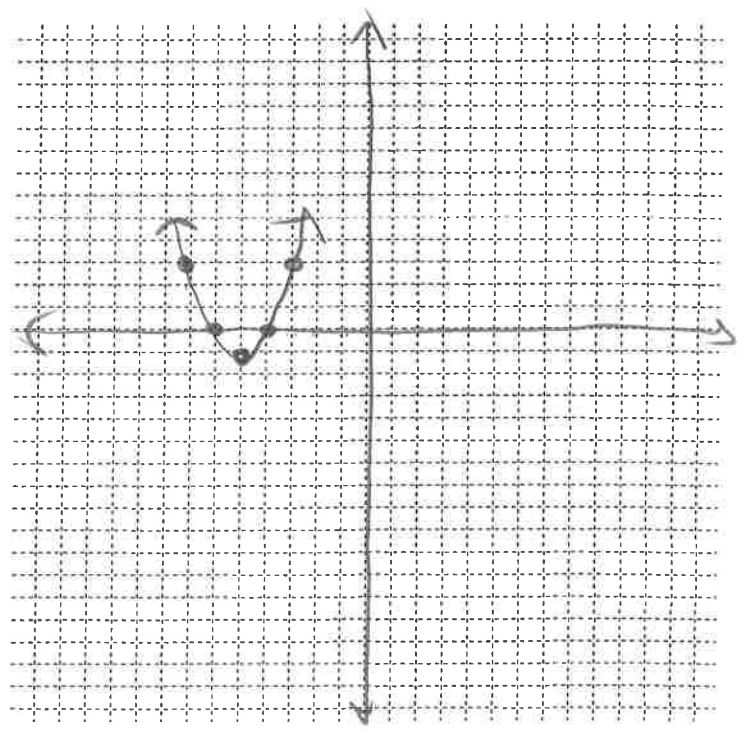
$$= 0$$

2.  $y = (x+5)^2 - 1$

axis of symmetry:  $x = -5$

vertex:  $(-5, -1)$

x	y
-4	$1 - 1 = 0$
-3	$4 - 1 = 3$



3.  $y = -2(x+6)(x-4)$

axis of symmetry:  $x = -1$

vertex:  $(-1, 50)$

$$y = (-2x - 12)(x - 4)$$

$$= -2x^2 + 8x - 12x + 48$$

$$y = -2x^2 - 4x + 48$$

$$x = \frac{-b}{2a} = \frac{4}{2(-2)} = -1$$

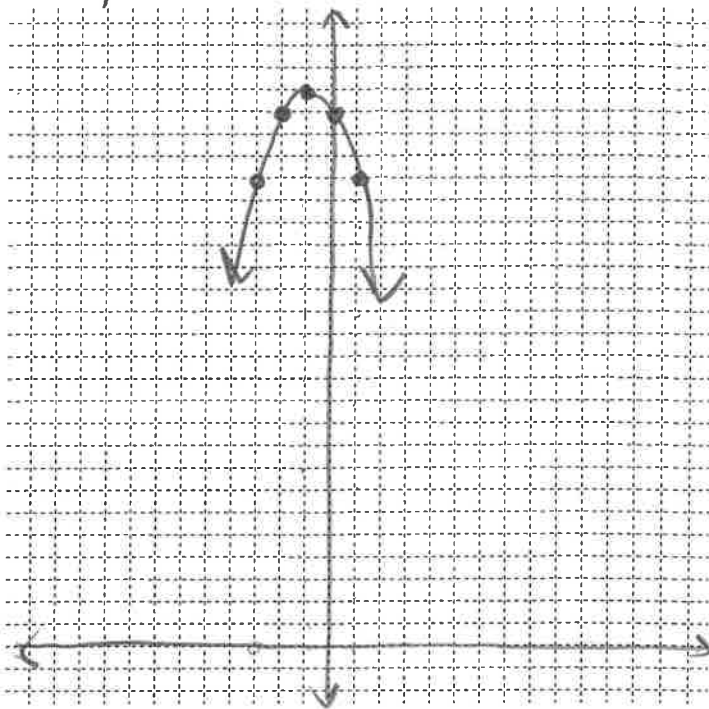
$$y = -2(-1+6)(-1-4)$$

$$= -2(5)(-5)$$

$$= 50$$

x	y
0	$-2(6)(-4) = 48$
1	$-2(7)(-3) = 42$

By 2's



Part II

Find the value of the discriminant, describe the nature of the roots and solve the equation in simplest radical form.

4.  $\frac{2}{3}x^2 - \frac{1}{2}x - 1 = 0$

$a = \frac{2}{3}$

$b = -\frac{1}{2}$

$c = -1$

discriminant  $\frac{35}{12}$

Nature of the roots 2 irrational

$x =$  SKIP

$$\left(-\frac{1}{2}\right)^2 - 4\left(\frac{2}{3}\right)(-1) = \frac{1}{4} + \frac{8}{3} = \frac{3}{12} + \frac{32}{12} = \frac{35}{12}$$

5.  $5x^2 + 13 = 0$

$a = 5$

$b = 0$

$c = 13$

discriminant  $-260$

Nature of the roots No real

$x =$  SKIP

$$b^2 - 4(ac) = 0^2 - 4(5)(13)$$

$$= -20(13) = -260$$

6.  $(x+2)(x-8) = 0$

$$x^2 - 8x + 2x - 16 = 0$$

$$x^2 - 6x - 16 = 0$$

$a = 1$

$b = -6$

$c = -16$

$$(-6)^2 - 4(1)(-16)$$

$$36 + 64$$

$$100$$

discriminant  $100$

Nature of the roots 2 rational

$x =$  SKIP

Part III

Solve the following quadratic equations by **completing the square**.

$$x^2 + 8x = 20$$

$$b = 8$$

$$\left(\frac{b}{2}\right)^2 = \left(\frac{8}{2}\right)^2 = 16$$

$$x^2 + 8x + 16 = 20 + 16$$

$$\sqrt{(x+4)^2} = \sqrt{36}$$

$$x+4 = \pm 6$$

$$x = -4 \pm 6$$

$$x = -4 + 6, -4 - 6 = 2, -10$$

$$\{-10, 2\}$$

$$10. \quad x^2 - 4x + 3 = 0 \quad x^2 - 4x = -3$$

$$b = -4$$

$$\left(\frac{b}{2}\right)^2 = \left(\frac{-4}{2}\right)^2 = 4$$

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

$$\sqrt{(x-2)^2} = \sqrt{1}$$

$$x-2 = \pm 1$$

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

$$\{1, 3\}$$

Part V

Solve by the quadratic formula. State a, b, and c. Show work and reduce to simplest radical form.

$$11. \quad 3d^2 - 14d + 15 = 0$$

$$a = 3 \quad b = -14 \quad c = 15$$

$$x = \frac{14 \pm \sqrt{196 - 4(3)(15)}}{2(3)}$$

$$= \frac{14 \pm \sqrt{196 - 180}}{6}$$

$$= \frac{14 \pm \sqrt{16}}{6}$$

$$= \frac{14 \pm 4}{6}$$

$$x = \frac{14+4}{6}, \frac{14-4}{6}$$

$$= \frac{18}{6}, \frac{10}{6}$$

$$= 3, \frac{5}{3}$$

$$\left\{\frac{5}{3}, 3\right\}$$

$$12. \quad 20m^2 - 2m + 7 = 0$$

$$a = 20 \quad b = -2 \quad c = 7$$

$$x = \frac{2 \pm \sqrt{4 - 4(20)(7)}}{2(20)}$$

$$= \frac{2 \pm \sqrt{4 - 560}}{40}$$

$$= \frac{2 \pm \sqrt{-556}}{40}$$

$$= \frac{2 \pm 2\sqrt{139}}{40}$$

$$= \frac{1 \pm \sqrt{139}}{20}$$

$$\left\{\frac{1 \pm \sqrt{139}}{20}\right\}$$

$$\begin{array}{r} 556 \\ \wedge \\ 2 \quad 274 \\ \wedge \\ 2 \quad 137 \end{array}$$

## Part VI

Simplify each of the following.

13.  $(7 + 8i) - (3 - 6i)$

$$7 + 8i - 3 + 6i$$

$$\boxed{4 + 14i}$$

14.  $(3 + 4i)(-2 - 6i)$

$$-6 - 18i - 8i - 24i^2$$

$$-6 - 26i + 24$$

$$\boxed{18 - 26i}$$

## Part VII

Solve by any method. Show all work.

15.  $x^2 - 44 = 100$

$$+44 \quad +44$$

$$\sqrt{x^2} = \sqrt{144}$$

$$x = \pm 12$$

$$\{\pm 12\}$$

16.  $3x^2 - 21x - 36 = 0$

$$a = 3 \quad b = -21 \quad c = -36$$

$$x = \frac{21 \pm \sqrt{(-21)^2 - 4(3)(-36)}}{2(3)}$$

$$x = \frac{21 \pm \sqrt{441 + 432}}{6}$$

$$= \frac{21 \pm \sqrt{873}}{6}$$

$$= \boxed{\frac{7 \pm \sqrt{97}}{2}}$$

Part VIII

Sketch graphs for the following inequalities.

17.  $y \leq x^2 - 4$

$$y = (x - 0)^2 - 4$$

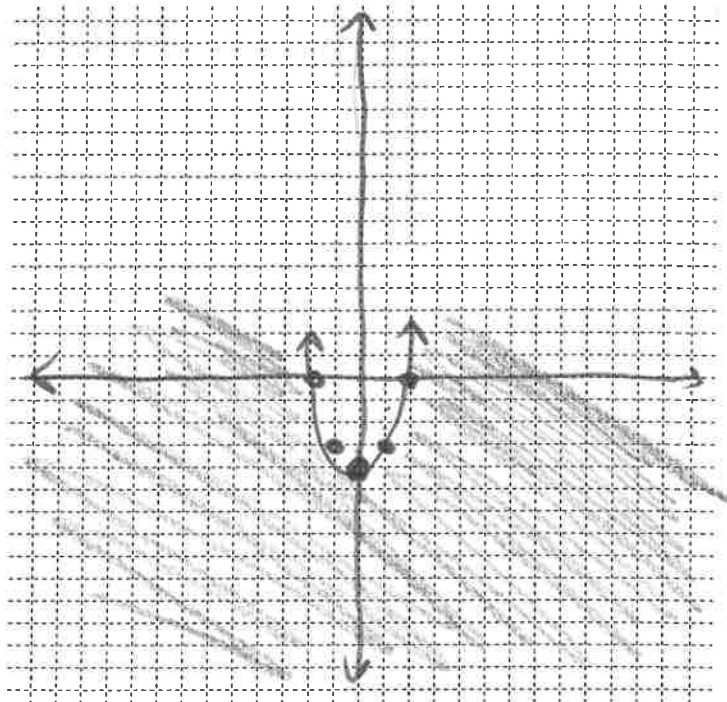
$$V: (0, -4)$$

x	y
1	$1 - 4 = -3$
2	$4 - 4 = 0$

Test:  $(0, 0)$

$$0 \leq 0 - 4$$

$$0 \leq -4 \quad \times$$



18.  $y \geq 3x^2 - 9$

$$y = 3(x - 0)^2 - 9$$

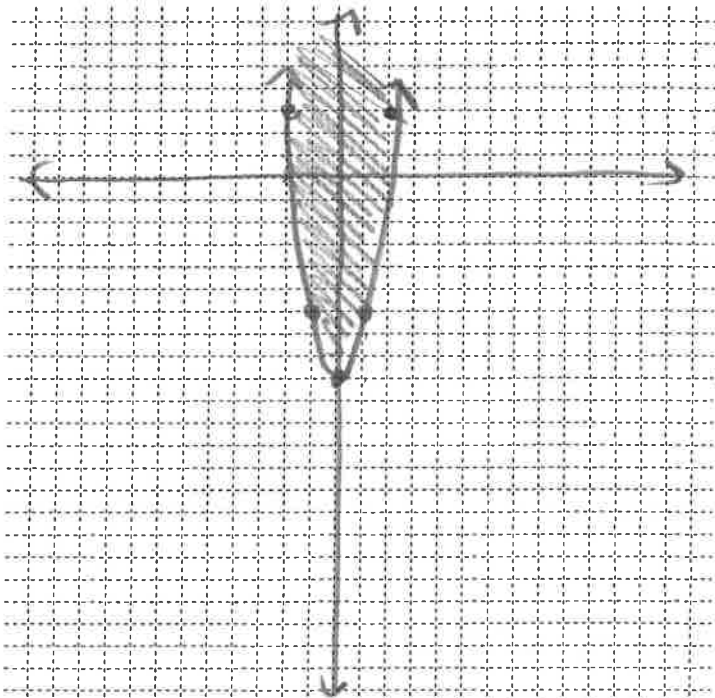
$$V: (0, -9)$$

x	y
1	$3 - 9 = -6$
2	$3(4) - 9 = 3$

Test:  $(0, 0)$

$$0 \geq 0 - 9$$

$$0 \geq -9 \quad \checkmark$$



Solve the following by factoring.

19.  $y = x^2 - 10x + 25$

$$y = (x-5)^2$$

$$0 = (x-5)(x-5)$$

$$x-5=0 \quad x-5=0$$

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

$$\{5\}$$

21.  $y = x^2 + x - 12$

$$y = (x+4)(x-3)$$

$$x+4=0 \quad x-3=0$$

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

$$\{-4, 3\}$$

20.  $y = x^2 - 49$

$$y = (x-7)(x+7)$$

$$x-7=0 \quad x+7=0$$

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

$$\{\pm 7\}$$

22.  $y = 2x^2 - 2x - 40$

$$y = 2(x^2 - x - 20)$$

$$y = 2(x-5)(x+4)$$

$$x-5=0 \quad x+4=0$$

$$x=5 \quad x=-4$$

$$\{-4, 5\}$$