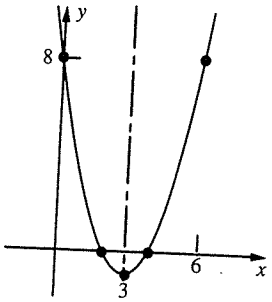
31. Vertex: (3, –1)

y-int. = 8

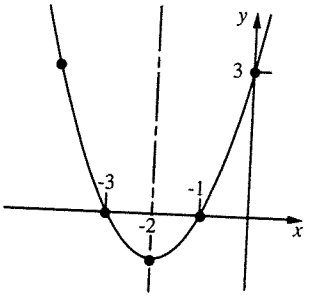
x-int. = 4, 2



32. Vertex: (–2, –1)

y-int. = 3

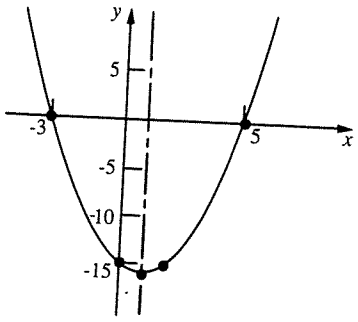
x-int. = –1, –3



33. Vertex: (1, –16)

y-int. = –15

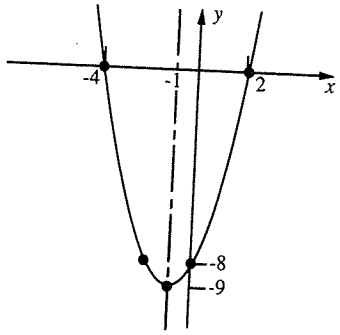
x-int. = 5, –3



34. Vertex: (–1, –9)

y-int. = –8

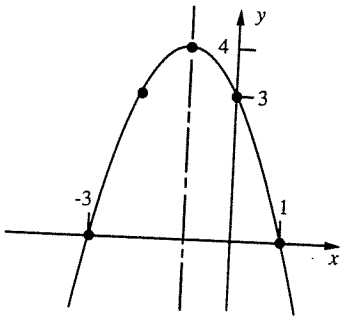
x-int. = 2, –4



35. Vertex: (–1, 4)

y-int. = 3

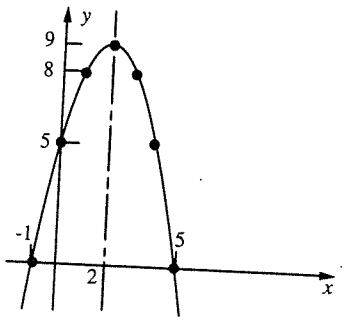
x-int. = 1, –3



36. Vertex: (2, 9)

y-int. = 5

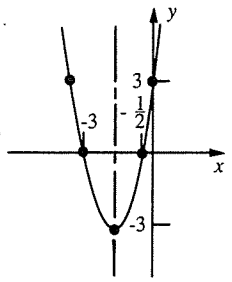
x-int. = 5, –1



37. Vertex: $(-1\frac{3}{4}, -3\frac{1}{8})$

y-int. = 3

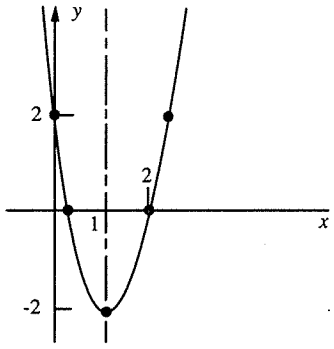
x-int. = $-\frac{1}{2}, -3$



38. Vertex: $(1\frac{1}{6}, -2\frac{1}{12})$

y-int. = 2

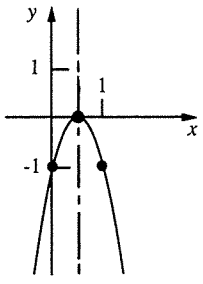
x-int. = $2, \frac{1}{3}$



39. Vertex: $(\frac{1}{2}, 0)$

y-int. = -1

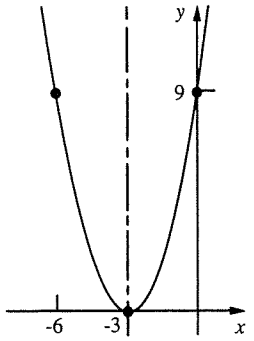
x-int. = $\frac{1}{2}$



40. Vertex: $(-3, 0)$

y-int. = 9

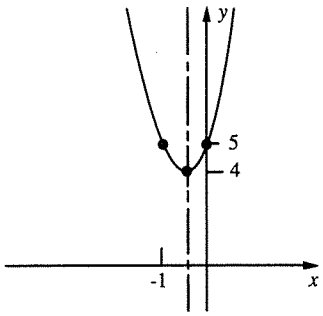
x-int. = -3



41. Vertex: $(-1, 4)$

y-int. = -3

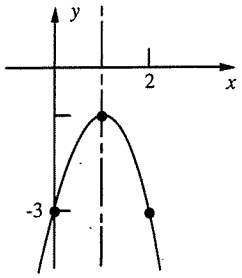
x-int. None.



42. Vertex: $(1, -1)$

y-int. = 5

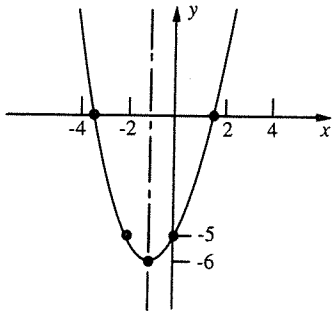
x-int. None.



43. Vertex: $(-1, -6)$

y-int. $= -5$

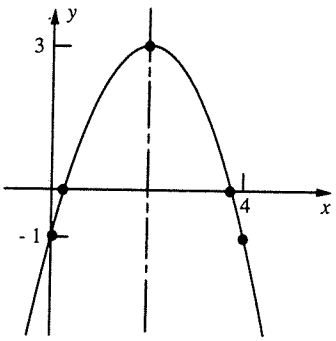
x-int. $= -1 \pm \sqrt{6}$
$\approx 1.4, -3.4$



44. Vertex: $(2, 3)$

y-int. $= -1$

x-int. $= 2 \pm \sqrt{3}$
$\approx 3.7, 0.3$



45. *Solving Quadratics by Completing the Square*

a. $x^2 + 6x + 4 = 0$

$$x^2 + 6x + 9 = -4 + 9$$
$$(x + 3)^2 = 5$$
$$x = -3 \pm \sqrt{5}$$
$$S = \{-3 + \sqrt{5}, -3 - \sqrt{5}\}$$
$$= \{-0.76393\ldots, -5.2360\ldots\}$$

b. $x^2 - 10x + 21 = 0$

$$x^2 - 10x + 25 = -21 + 25$$
$$(x - 5)^2 = 4$$
$$x = 5 \pm 2$$
$$S = \{7, 3\}$$

c. $7x^2 + 14x + 3 = 0$

$$x^2 + 2x + 1 = -\frac{3}{7} + 1$$
$$(x + 1)^2 = \frac{4}{7}$$
$$x = -1 \pm \sqrt{\frac{4}{7}}$$
$$S = \{-0.24407\ldots, -1.75592\ldots\}$$

d. $x^2 - 7x - 4 = 0$

$$x^2 - 7x + 12.25 = 4 + 12.25$$
$$(x - 3.5)^2 = 16.25$$
$$x = 3.5 \pm \sqrt{16.25}$$
$$S = \{7.53112\ldots, -0.53112\ldots\}$$

e. $2x^2 - 10x + 11 = 0$

$$x^2 - 5x + 6.25 = -\frac{11}{2} + 6.25$$
$$(x - 2.5)^2 = 0.75$$
$$x = 2.5 \pm \sqrt{0.75}$$
$$S = \{3.36602\ldots, 1.63397\ldots\}$$

46. *Derivation of the Quadratic Formula, Part I*

$7x^2 + 13x + 5 = 0$

$$x^2 + \frac{13}{7}x + \frac{169}{196} = \frac{169}{196} - \frac{5}{7}$$
$$\left(x + \frac{13}{14}\right)^2 = \frac{169 - 28 \cdot 5}{196}$$
$$x + \frac{13}{14} = \pm\frac{\sqrt{169 - 28 \cdot 5}}{14}$$
$$x = \frac{-13 \pm \sqrt{169 - 28 \cdot 5}}{14}$$
$$x = \frac{-13 \pm \sqrt{13^2 - 4 \cdot 7 \cdot 5}}{2 \cdot 7}$$

47. *Derivation of the Quadratic Formula, Part II*

$ax^2 + bx + c = 0$

$$x^2 + \frac{b}{a}x + \frac{b^2}{4a^2} = \frac{b^2}{4a^2} - \frac{c}{a}$$
$$\left(x + \frac{b}{2a}\right)^2 = \frac{b^2 - 4ac}{4a^2}$$
$$x + \frac{b}{2a} = \pm\frac{\sqrt{b^2 - 4ac}}{2a}$$
$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \text{ QED}$$

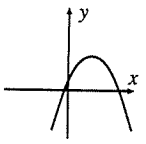
EXERCISE 5-4, page 193; Imaginary and Complex Numbers

Q1. $(p + 5)^2 = p^2 + 10p + 25$

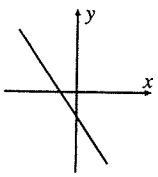
Q2. $(y - 7)^2 = y^2 - 14y + 49$

Q3. $(3x + 8)^2 = 9x^2 + 48x + 64$ **Q4.** $13^2 = 169$

Q5. e.g.



Q6. e.g.



Q7. $x^2 + 7x + 20 = 0$: disc. $= -31$

Q8. $\begin{vmatrix} 3 & 7 \\ 4 & 9 \end{vmatrix} = -1$

Q9. $0.02(700) = 14$

Q10. $\frac{2}{3} + \frac{3}{4} = 1\frac{5}{12}$