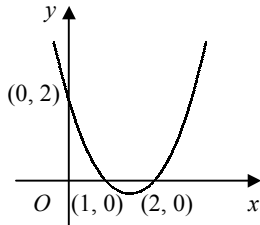
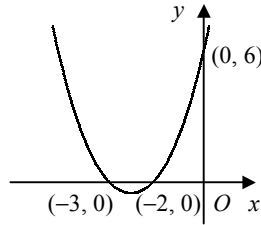




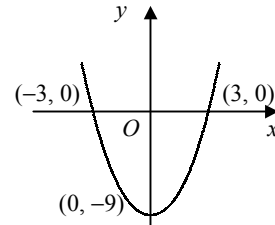
5 a  $x^2 - 3x + 2 = 0$   
 $(x-1)(x-2) = 0$   
 $x = 1$  or  $2$



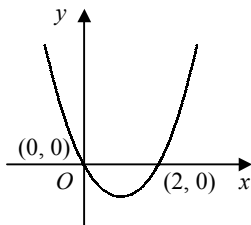
b  $x^2 + 5x + 6 = 0$   
 $(x+3)(x+2) = 0$   
 $x = -3$  or  $-2$



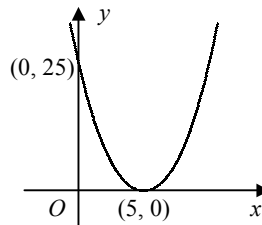
c  $x^2 - 9 = 0$   
 $(x+3)(x-3) = 0$   
 $x = -3$  or  $3$



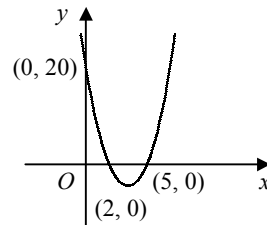
d  $x^2 - 2x = 0$   
 $x(x-2) = 0$   
 $x = 0$  or  $2$



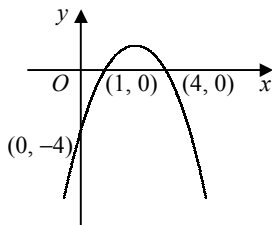
e  $x^2 - 10x + 25 = 0$   
 $(x-5)^2 = 0$   
 $x = 5$



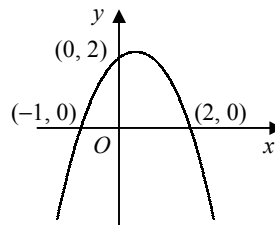
f  $2x^2 - 14x + 20 = 0$   
 $2(x-2)(x-5) = 0$   
 $x = 2$  or  $5$



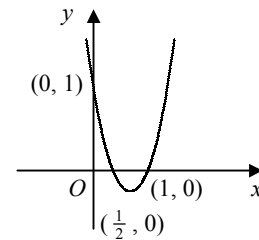
g  $-x^2 + 5x - 4 = 0$   
 $x^2 - 5x + 4 = 0$   
 $(x-1)(x-4) = 0$   
 $x = 1$  or  $4$



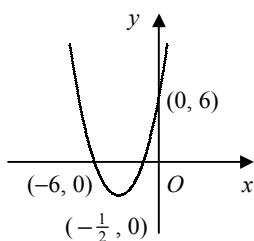
h  $2 + x - x^2 = 0$   
 $x^2 - x - 2 = 0$   
 $(x+1)(x-2) = 0$   
 $x = -1$  or  $2$



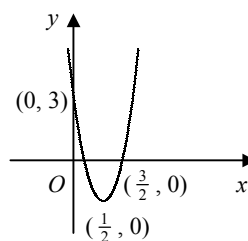
i  $2x^2 - 3x + 1 = 0$   
 $(2x-1)(x-1) = 0$   
 $x = \frac{1}{2}$  or  $1$



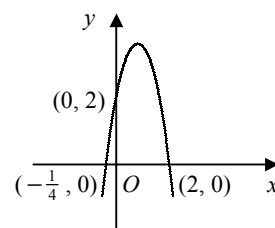
j  $2x^2 + 13x + 6 = 0$   
 $(2x+1)(x+6) = 0$   
 $x = -6$  or  $-\frac{1}{2}$



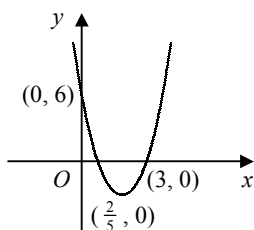
k  $3 - 8x + 4x^2 = 0$   
 $(2x-1)(2x-3) = 0$   
 $x = \frac{1}{2}$  or  $\frac{3}{2}$



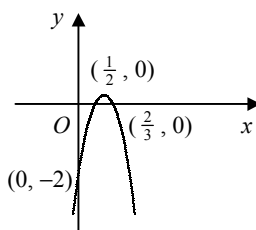
l  $2 + 7x - 4x^2 = 0$   
 $4x^2 - 7x - 2 = 0$   
 $(4x+1)(x-2) = 0$   
 $x = -\frac{1}{4}$  or  $2$



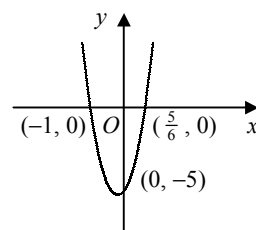
$$\begin{aligned} \text{m } 5x^2 - 17x + 6 &= 0 \\ (5x - 2)(x - 3) &= 0 \\ x &= \frac{2}{5} \text{ or } 3 \end{aligned}$$



$$\begin{aligned} \text{n } -6x^2 + 7x - 2 &= 0 \\ 6x^2 - 7x + 2 &= 0 \\ (2x - 1)(3x - 2) &= 0 \\ x &= \frac{1}{2} \text{ or } \frac{2}{3} \end{aligned}$$



$$\begin{aligned} \text{o } 6x^2 + x - 5 &= 0 \\ (6x - 5)(x + 1) &= 0 \\ x &= -1 \text{ or } \frac{5}{6} \end{aligned}$$



$$\begin{aligned} 6 \quad \text{a } x^2 - 5x + 4 &= 0 \\ (x - 1)(x - 4) &= 0 \\ x &= 1 \text{ or } 4 \end{aligned}$$

$$\begin{aligned} \text{b } x^2 - 10 &= 3x \\ x^2 - 3x - 10 &= 0 \\ (x + 2)(x - 5) &= 0 \\ x &= -2 \text{ or } 5 \end{aligned}$$

$$\begin{aligned} \text{c } x(2x^2 - x - 3) &= 0 \\ x(2x - 3)(x + 1) &= 0 \\ x &= -1, 0 \text{ or } \frac{3}{2} \end{aligned}$$

$$\begin{aligned} \text{d } 10x^2 - x^4 &= 9 \\ x^4 - 10x^2 + 9 &= 0 \\ (x^2 - 1)(x^2 - 9) &= 0 \\ x^2 &= 1 \text{ or } 9 \\ x &= \pm 1 \text{ or } \pm 3 \end{aligned}$$

$$\begin{aligned} \text{e } 5 + 4x - x^2 &= 0 \\ x^2 - 4x - 5 &= 0 \\ (x + 1)(x - 5) &= 0 \\ x &= -1 \text{ or } 5 \end{aligned}$$

$$\begin{aligned} \text{f } x - 6 &= x(x - 4) \\ x - 6 &= x^2 - 4x \\ x^2 - 5x + 6 &= 0 \\ (x - 2)(x - 3) &= 0 \\ x &= 2 \text{ or } 3 \end{aligned}$$

$$\begin{aligned} \text{g } (x + 5)(x + 3) &= 3 \\ x^2 + 8x + 15 &= 3 \\ x^2 + 8x + 12 &= 0 \\ (x + 6)(x + 2) &= 0 \\ x &= -6 \text{ or } -2 \end{aligned}$$

$$\begin{aligned} \text{h } x^4 - 4 &= 3x^2 \\ x^4 - 3x^2 - 4 &= 0 \\ (x^2 + 1)(x^2 - 4) &= 0 \\ x^2 &= -1 \text{ (no sol's) or } 4 \\ x &= \pm 2 \end{aligned}$$

$$\begin{aligned} \text{i } 4x^4 + 7x^2 - 2 &= 0 \\ (4x^2 - 1)(x^2 + 2) &= 0 \\ x^2 &= -2 \text{ (no sol's) or } \frac{1}{4} \\ x &= \pm \frac{1}{2} \end{aligned}$$

$$\begin{aligned} \text{j } 2x(x + 2) &= 3 - x \\ 2x^2 + 4x &= 3 - x \\ 2x^2 + 5x - 3 &= 0 \\ (2x - 1)(x + 3) &= 0 \\ x &= -3 \text{ or } \frac{1}{2} \end{aligned}$$

$$\begin{aligned} \text{k } x(2x + 1) &= 2(x + 3) \\ 2x^2 + x &= 2x + 6 \\ 2x^2 - x - 6 &= 0 \\ (2x + 3)(x - 2) &= 0 \\ x &= -\frac{3}{2} \text{ or } 2 \end{aligned}$$

$$\begin{aligned} \text{l } 7 - 3x(x + 2) &= 2(x + 2) \\ 7 - 3x^2 - 6x &= 2x + 4 \\ 3x^2 + 8x - 3 &= 0 \\ (3x - 1)(x + 3) &= 0 \\ x &= -3 \text{ or } \frac{1}{3} \end{aligned}$$

- 1**    **a**  $= (x+1)^2 - 1 + 4$     **b**  $= (x-1)^2 - 1 + 4$     **c**  $= (x-2)^2 - 4 + 1$     **d**  $= (x+3)^2 - 9$   
 $= (x+1)^2 + 3$      $= (x-1)^2 + 3$      $= (x-2)^2 - 3$
- e**  $= (x+2)^2 - 4 + 8$     **f**  $= (x-4)^2 - 16 - 5$     **g**  $= (x+6)^2 - 36 + 30$     **h**  $= (x-5)^2 - 25 + 25$   
 $= (x+2)^2 + 4$      $= (x-4)^2 - 21$      $= (x+6)^2 - 6$      $= (x-5)^2$
- i**  $= (x+3)^2 - 9 - 9$     **j**  $= (x-2)^2 - 4 + 18$     **k**  $= (x + \frac{3}{2})^2 - \frac{9}{4} + 3$     **l**  $= (x + \frac{1}{2})^2 - \frac{1}{4} - 1$   
 $= (x+3)^2 - 18$      $= (x-2)^2 + 14$      $= (x + \frac{3}{2})^2 + \frac{3}{4}$      $= (x + \frac{1}{2})^2 - \frac{5}{4}$
- m**  $= (x-9)^2 - 81 + 100$     **n**  $= (x - \frac{1}{2})^2 - \frac{1}{4} - \frac{1}{2}$     **o**  $= (x + \frac{9}{2})^2 - \frac{81}{4} + 20$     **p**  $= (x - \frac{7}{2})^2 - \frac{49}{4} - 2$   
 $= (x-9)^2 + 19$      $= (x - \frac{1}{2})^2 - \frac{3}{4}$      $= (x + \frac{9}{2})^2 - \frac{1}{4}$      $= (x - \frac{7}{2})^2 - \frac{57}{4}$
- q**  $= (x - \frac{3}{2})^2 - \frac{9}{4} + 5$     **r**  $= (x - \frac{11}{2})^2 - \frac{121}{4} + 37$     **s**  $= (x + \frac{1}{3})^2 - \frac{1}{9} + 1$     **t**  $= (x - \frac{1}{4})^2 - \frac{1}{16} - \frac{1}{4}$   
 $= (x - \frac{3}{2})^2 + \frac{11}{4}$      $= (x - \frac{11}{2})^2 + \frac{27}{4}$      $= (x + \frac{1}{3})^2 + \frac{8}{9}$      $= (x - \frac{1}{4})^2 - \frac{5}{16}$
- 2**    **a**  $= 2[x^2 + 2x] + 3$     **b**  $= 2[x^2 - 4x] - 7$     **c**  $= 3[x^2 - 2x] + 3$     **d**  $= 4[x^2 + 6x] + 11$   
 $= 2[(x+1)^2 - 1] + 3$      $= 2[(x-2)^2 - 4] - 7$      $= 3[(x-1)^2 - 1] + 3$      $= 4[(x+3)^2 - 9] + 11$   
 $= 2(x+1)^2 + 1$      $= 2(x-2)^2 - 15$      $= 3(x-1)^2$      $= 4(x+3)^2 - 25$
- e**  $= -[x^2 + 2x] - 5$     **f**  $= -[x^2 - 10x] + 1$     **g**  $= 2[x^2 + x] - 1$     **h**  $= 3[x^2 - 3x] + 5$   
 $= -[(x+1)^2 - 1] - 5$      $= -[(x-5)^2 - 25] + 1$      $= 2[(x + \frac{1}{2})^2 - \frac{1}{4}] - 1$      $= 3[(x - \frac{3}{2})^2 - \frac{9}{4}] + 5$   
 $= -(x+1)^2 - 4$      $= -(x-5)^2 + 26$      $= 2(x + \frac{1}{2})^2 - \frac{3}{2}$      $= 3(x - \frac{3}{2})^2 - \frac{7}{4}$
- i**  $= 3[x^2 - 8x] + 48$     **j**  $= 3[x^2 - 5x]$     **k**  $= 5[x^2 + 8x] + 70$     **l**  $= 2[x^2 + \frac{5}{2}x] + 2$   
 $= 3[(x-4)^2 - 16] + 48$      $= 3[(x - \frac{5}{2})^2 - \frac{25}{4}]$      $= 5[(x+4)^2 - 16] + 70$      $= 2[(x + \frac{5}{4})^2 - \frac{25}{16}] + 2$   
 $= 3(x-4)^2$      $= 3(x - \frac{5}{2})^2 - \frac{75}{4}$      $= 5(x+4)^2 - 10$      $= 2(x + \frac{5}{4})^2 - \frac{9}{8}$
- m**  $= 4[x^2 + \frac{3}{2}x] - 7$     **n**  $= -2[x^2 - 2x] - 1$     **o**  $= -3[x^2 + \frac{2}{3}x] + 4$     **p**  $= \frac{1}{3}[x^2 + \frac{3}{2}x] - \frac{1}{4}$   
 $= 4[(x + \frac{3}{4})^2 - \frac{9}{16}] - 7$      $= -2[(x-1)^2 - 1] - 1$      $= -3[(x + \frac{1}{3})^2 - \frac{1}{9}] + 4$      $= \frac{1}{3}[(x + \frac{3}{4})^2 - \frac{9}{16}] - \frac{1}{4}$   
 $= 4(x + \frac{3}{4})^2 - \frac{37}{4}$      $= -2(x-1)^2 + 1$      $= -3(x + \frac{1}{3})^2 + \frac{13}{3}$      $= \frac{1}{3}(x + \frac{3}{4})^2 - \frac{7}{16}$
- 3**    **a**  $(y-2)^2 - 4 + 2 = 0$     **b**  $(p+1)^2 - 1 - 2 = 0$     **c**  $(x-3)^2 - 9 + 4 = 0$     **d**  $(r+5)^2 - 25 + 7 = 0$   
 $(y-2)^2 = 2$      $(p+1)^2 = 3$      $(x-3)^2 = 5$      $(r+5)^2 = 18$   
 $y-2 = \pm\sqrt{2}$      $p+1 = \pm\sqrt{3}$      $x-3 = \pm\sqrt{5}$      $r+5 = \pm\sqrt{18} = \pm 3\sqrt{2}$   
 $y = 2 \pm\sqrt{2}$      $p = -1 \pm\sqrt{3}$      $x = 3 \pm\sqrt{5}$      $r = -5 \pm 3\sqrt{2}$
- e**  $(x-1)^2 - 1 = 11$     **f**  $(a-6)^2 - 36 - 18 = 0$     **g**  $(m - \frac{3}{2})^2 - \frac{9}{4} + 1 = 0$     **h**  $(t - \frac{7}{2})^2 - \frac{49}{4} + 9 = 0$   
 $(x-1)^2 = 12$      $(a-6)^2 = 54$      $(m - \frac{3}{2})^2 = \frac{5}{4}$      $(t - \frac{7}{2})^2 = \frac{13}{4}$   
 $x-1 = \pm\sqrt{12} = \pm 2\sqrt{3}$      $a-6 = \pm\sqrt{54} = \pm 3\sqrt{6}$      $m - \frac{3}{2} = \pm\frac{\sqrt{5}}{2}$      $t - \frac{7}{2} = \pm\frac{\sqrt{13}}{2}$   
 $x = 1 \pm 2\sqrt{3}$      $a = 6 \pm 3\sqrt{6}$      $m = \frac{1}{2}(3 \pm \sqrt{5})$      $t = \frac{1}{2}(7 \pm \sqrt{13})$

$$\begin{array}{llll} \mathbf{i} & (u + \frac{7}{2})^2 - \frac{49}{4} = 44 & \mathbf{j} & y^2 - 2y + \frac{1}{2} = 0 & \mathbf{k} & p^2 + 6p = -\frac{23}{3} & \mathbf{l} & x^2 + 6x = \frac{9}{2} \\ & (u + \frac{7}{2})^2 = \frac{225}{4} & & (y-1)^2 - 1 + \frac{1}{2} = 0 & & (p+3)^2 - 9 = -\frac{23}{3} & & (x+3)^2 - 9 = \frac{9}{2} \\ & u + \frac{7}{2} = \pm \frac{15}{2} & & (y-1)^2 = \frac{1}{2} & & (p+3)^2 = \frac{4}{3} & & (x+3)^2 = \frac{27}{2} \\ & u = -\frac{7}{2} \pm \frac{15}{2} & & y-1 = \pm \frac{1}{\sqrt{2}} = \pm \frac{1}{2}\sqrt{2} & & p+3 = \pm \frac{2}{\sqrt{3}} = \pm \frac{2}{3}\sqrt{3} & & x+3 = \pm \sqrt{\frac{27}{2}} = \pm \frac{3}{2}\sqrt{6} \\ & u = -11 \text{ or } 4 & & y = 1 \pm \frac{1}{2}\sqrt{2} & & p = -3 \pm \frac{2}{3}\sqrt{3} & & x = -3 \pm \frac{3}{2}\sqrt{6} \end{array}$$

$$\begin{array}{llll} \mathbf{m} & m^2 - m = 1 & \mathbf{n} & 4x^2 - 28x + 49 = 0 & \mathbf{o} & t^2 + \frac{1}{3}t = \frac{1}{3} & \mathbf{p} & a^2 - \frac{7}{2}a + 2 = 0 \\ & (m - \frac{1}{2})^2 - \frac{1}{4} = 1 & & x^2 - 7x + \frac{49}{4} = 0 & & (t + \frac{1}{6})^2 - \frac{1}{36} = \frac{1}{3} & & (a - \frac{7}{4})^2 - \frac{49}{16} + 2 = 0 \\ & (m - \frac{1}{2})^2 = \frac{5}{4} & & (x - \frac{7}{2})^2 - \frac{49}{4} + \frac{49}{4} = 0 & & (t + \frac{1}{6})^2 = \frac{13}{36} & & (a - \frac{7}{4})^2 = \frac{17}{16} \\ & m - \frac{1}{2} = \pm \frac{\sqrt{5}}{2} & & (x - \frac{7}{2})^2 = 0 & & t + \frac{1}{6} = \pm \frac{\sqrt{13}}{6} & & a - \frac{7}{4} = \pm \frac{\sqrt{17}}{4} \\ & m = \frac{1}{2}(1 \pm \sqrt{5}) & & x = \frac{7}{2} & & t = \frac{1}{6}(-1 \pm \sqrt{13}) & & a = \frac{1}{4}(7 \pm \sqrt{17}) \end{array}$$

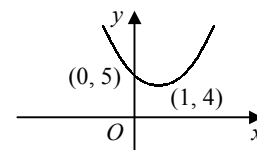
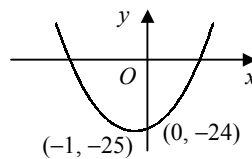
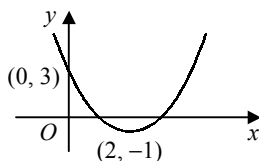
$$\begin{array}{lll} \mathbf{4} & \mathbf{a} & y = (x-1)^2 - 1 + 7 \\ & & y = (x-1)^2 + 6 \\ & & y = 6 \text{ at } x = 1, \text{ minimum} \\ & \mathbf{b} & y = (x+1)^2 - 1 - 3 \\ & & y = (x+1)^2 - 4 \\ & & y = -4 \text{ at } x = -1, \text{ minimum} \\ & \mathbf{c} & y = (x-3)^2 - 9 + 1 \\ & & y = (x-3)^2 - 8 \\ & & y = -8 \text{ at } x = 3, \text{ minimum} \end{array}$$

$$\begin{array}{lll} \mathbf{d} & y = (x+5)^2 - 25 + 35 \\ & y = (x+5)^2 + 10 \\ & y = 10 \text{ at } x = -5, \text{ minimum} \\ \mathbf{e} & y = -[x^2 - 4x] + 4 \\ & y = -[(x-2)^2 - 4] + 4 \\ & y = -(x-2)^2 + 8 \\ & y = 8 \text{ at } x = 2, \text{ maximum} \\ \mathbf{f} & y = (x + \frac{3}{2})^2 - \frac{9}{4} - 2 \\ & y = (x + \frac{3}{2})^2 - \frac{17}{4} \\ & y = -\frac{17}{4} \text{ at } x = -\frac{3}{2}, \text{ minimum} \end{array}$$

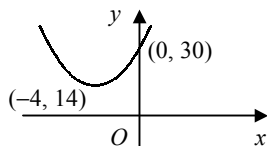
$$\begin{array}{lll} \mathbf{g} & y = 2[x^2 + 4x] + 5 \\ & y = 2[(x+2)^2 - 4] + 5 \\ & y = 2(x+2)^2 - 3 \\ & y = -3 \text{ at } x = -2, \text{ minimum} \\ \mathbf{h} & y = -3[x^2 - 2x] \\ & y = -3[(x-1)^2 - 1] \\ & y = -3(x-1)^2 + 3 \\ & y = 3 \text{ at } x = 1, \text{ maximum} \\ \mathbf{i} & y = -[x^2 + 5x] + 7 \\ & y = -[(x + \frac{5}{2})^2 - \frac{25}{4}] + 7 \\ & y = -(x + \frac{5}{2})^2 + \frac{53}{4} \\ & y = \frac{53}{4} \text{ at } x = -\frac{5}{2}, \text{ maximum} \end{array}$$

$$\begin{array}{lll} \mathbf{j} & y = 4[x^2 - 3x] + 9 \\ & y = 4[(x - \frac{3}{2})^2 - \frac{9}{4}] + 9 \\ & y = 4(x - \frac{3}{2})^2 \\ & y = 0 \text{ at } x = \frac{3}{2}, \text{ minimum} \\ \mathbf{k} & y = 4[x^2 + 5x] - 8 \\ & y = 4[(x + \frac{5}{2})^2 - \frac{25}{4}] - 8 \\ & y = 4(x + \frac{5}{2})^2 - 33 \\ & y = -33 \text{ at } x = -\frac{5}{2}, \text{ minimum} \\ \mathbf{l} & y = -2[x^2 + x] + 17 \\ & y = -2[(x + \frac{1}{2})^2 - \frac{1}{4}] + 17 \\ & y = -2(x + \frac{1}{2})^2 + \frac{35}{2} \\ & y = \frac{35}{2} \text{ at } x = -\frac{1}{2}, \text{ maximum} \end{array}$$

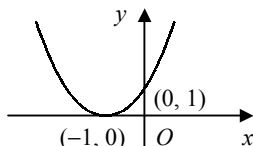
$$\begin{array}{lll} \mathbf{5} & \mathbf{a} & y = (x-2)^2 - 4 + 3 \\ & & y = (x-2)^2 - 1 \\ & & \text{minimum } (2, -1) \\ & \mathbf{b} & y = (x+1)^2 - 1 - 24 \\ & & y = (x+1)^2 - 25 \\ & & \text{minimum } (-1, -25) \\ & \mathbf{c} & y = (x-1)^2 - 1 + 5 \\ & & y = (x-1)^2 + 4 \\ & & \text{minimum } (1, 4) \end{array}$$



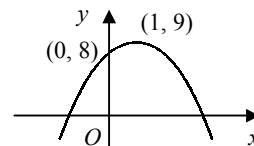
**d**  $y = (x + 4)^2 - 16 + 30$   
 $y = (x + 4)^2 + 14$   
 minimum  $(-4, 14)$



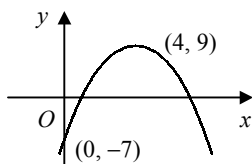
**e**  $y = (x + 1)^2 - 1 + 1$   
 $y = (x + 1)^2$   
 minimum  $(-1, 0)$



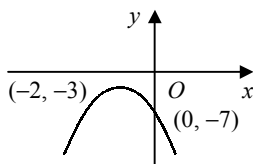
**f**  $y = -[x^2 - 2x] + 8$   
 $y = -[(x - 1)^2 - 1] + 8$   
 $y = -(x - 1)^2 + 9$   
 maximum  $(1, 9)$



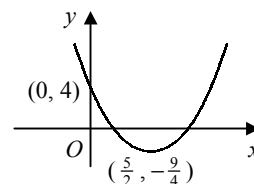
**g**  $y = -[x^2 - 8x] - 7$   
 $y = -[(x - 4)^2 - 16] - 7$   
 $y = -(x - 4)^2 + 9$   
 maximum  $(4, 9)$



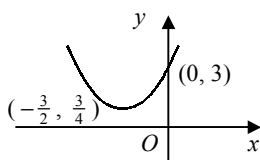
**h**  $y = -[x^2 + 4x] - 7$   
 $y = -[(x + 2)^2 - 4] - 7$   
 $y = -(x + 2)^2 - 3$   
 maximum  $(-2, -3)$



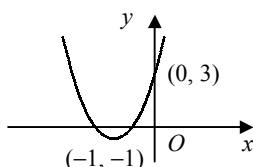
**i**  $y = (x - \frac{5}{2})^2 - \frac{25}{4} + 4$   
 $y = (x - \frac{5}{2})^2 - \frac{9}{4}$   
 minimum  $(\frac{5}{2}, -\frac{9}{4})$



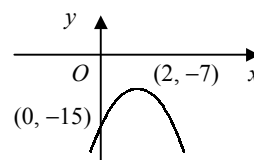
**j**  $y = (x + \frac{3}{2})^2 - \frac{9}{4} + 3$   
 $y = (x + \frac{3}{2})^2 + \frac{3}{4}$   
 minimum  $(-\frac{3}{2}, \frac{3}{4})$



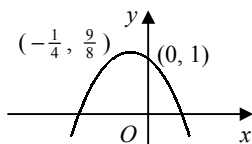
**k**  $y = 4[x^2 + 2x] + 3$   
 $y = 4[(x + 1)^2 - 1] + 3$   
 $y = 4(x + 1)^2 - 1$   
 minimum  $(-1, -1)$



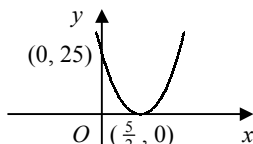
**l**  $y = -2[x^2 - 4x] - 15$   
 $y = -2[(x - 2)^2 - 4] - 15$   
 $y = -2(x - 2)^2 - 7$   
 maximum  $(2, -7)$



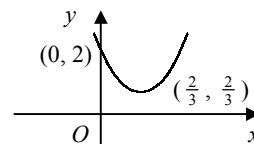
**m**  $y = -2[x^2 + \frac{1}{2}x] + 1$   
 $y = -2[(x + \frac{1}{4})^2 - \frac{1}{16}] + 1$   
 $y = -2(x + \frac{1}{4})^2 + \frac{9}{8}$   
 maximum  $(-\frac{1}{4}, \frac{9}{8})$



**n**  $y = 4[x^2 - 5x] + 25$   
 $y = 4[(x - \frac{5}{2})^2 - \frac{25}{4}] + 25$   
 $y = 4(x - \frac{5}{2})^2$   
 minimum  $(\frac{5}{2}, 0)$



**o**  $y = 3[x^2 - \frac{4}{3}x] + 2$   
 $y = 3[(x - \frac{2}{3})^2 - \frac{4}{9}] + 2$   
 $y = 3(x - \frac{2}{3})^2 + \frac{2}{3}$   
 minimum  $(\frac{2}{3}, \frac{2}{3})$



**6 a**  $= (x - 2\sqrt{2})^2 - 8 + 5$   
 $= (x - 2\sqrt{2})^2 - 3$

**b**  $x = 2\sqrt{2}$

**7**  $x^2 + 2kx - 3 = 0$   
 $(x + k)^2 - k^2 - 3 = 0$   
 $(x + k)^2 = k^2 + 3$   
 $x + k = \pm\sqrt{k^2 + 3}$   
 $x = -k \pm \sqrt{k^2 + 3}$

**1**  $ax^2 + bx + c = 0$

$$x^2 + \frac{b}{a}x + \frac{c}{a} = 0$$

$$\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a^2} + \frac{c}{a} = 0$$

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

$$x + \frac{b}{2a} = \pm \sqrt{\frac{b^2 - 4ac}{4a^2}} = \pm \frac{\sqrt{b^2 - 4ac}}{2a}$$

$$x = -\frac{b}{2a} \pm \frac{\sqrt{b^2 - 4ac}}{2a} = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

**2 a**  $x = \frac{-4 \pm \sqrt{16-4}}{2}$

$$x = \frac{-4 \pm 2\sqrt{3}}{2}$$

$$x = -2 \pm \sqrt{3}$$

**b**  $t = \frac{-8 \pm \sqrt{64+16}}{-2}$

$$t = \frac{-8 \pm 4\sqrt{5}}{-2}$$

$$t = 4 \pm 2\sqrt{5}$$

**c**  $y = \frac{20 \pm \sqrt{400-364}}{2}$

$$y = \frac{20 \pm 6}{2}$$

$$y = 7 \text{ or } 13$$

**d**  $r = \frac{-2 \pm \sqrt{4+28}}{2}$

$$r = \frac{-2 \pm 4\sqrt{2}}{2}$$

$$r = -1 \pm 2\sqrt{2}$$

**e**  $a = \frac{-18 \pm \sqrt{324-24}}{2}$

$$a = \frac{-18 \pm 10\sqrt{3}}{2}$$

$$a = -9 \pm 5\sqrt{3}$$

**f**  $m^2 - 5m - 5 = 0$

$$m = \frac{5 \pm \sqrt{25+20}}{2}$$

$$m = \frac{1}{2}(5 \pm 3\sqrt{5})$$

**g**  $x = \frac{-11 \pm \sqrt{121-108}}{2}$

$$x = \frac{1}{2}(-11 \pm \sqrt{13})$$

**h**  $u = \frac{-6 \pm \sqrt{36-24}}{4}$

$$u = \frac{-6 \pm 2\sqrt{3}}{4}$$

$$u = \frac{1}{2}(-3 \pm \sqrt{3})$$

**i**  $y = \frac{1 \pm \sqrt{1+20}}{-2}$

$$y = -\frac{1}{2}(1 \pm \sqrt{21})$$

**j**  $2x^2 - 3x - 2 = 0$

$$x = \frac{3 \pm \sqrt{9+16}}{4}$$

$$x = \frac{3 \pm 5}{4}$$

$$x = -\frac{1}{2} \text{ or } 2$$

**k**  $p = \frac{-7 \pm \sqrt{49-12}}{6}$

$$p = \frac{1}{6}(-7 \pm \sqrt{37})$$

**l**  $t^2 - 14t - 14 = 0$

$$t = \frac{14 \pm \sqrt{196+56}}{2}$$

$$t = \frac{14 \pm 6\sqrt{7}}{2}$$

$$t = 7 \pm 3\sqrt{7}$$

**m**  $r^2 + 14r - 9 = 0$

$$r = \frac{-14 \pm \sqrt{196+36}}{2}$$

$$r = \frac{-14 \pm 2\sqrt{58}}{2}$$

$$r = -7 \pm \sqrt{58}$$

**n**  $6u^2 + 4u - 1 = 0$

$$u = \frac{-4 \pm \sqrt{16+24}}{12}$$

$$u = \frac{-4 \pm 2\sqrt{10}}{12}$$

$$u = \frac{1}{6}(-2 \pm \sqrt{10})$$

**o**  $3y^2 - 18y - 4 = 0$

$$y = \frac{18 \pm \sqrt{324+48}}{6}$$

$$y = \frac{18 \pm 2\sqrt{93}}{6}$$

$$y = 3 \pm \frac{1}{3}\sqrt{93}$$

**p**  $4x^2 - 8x - 11 = 0$

$$x = \frac{8 \pm \sqrt{64+176}}{8}$$

$$x = \frac{8 \pm 4\sqrt{15}}{8}$$

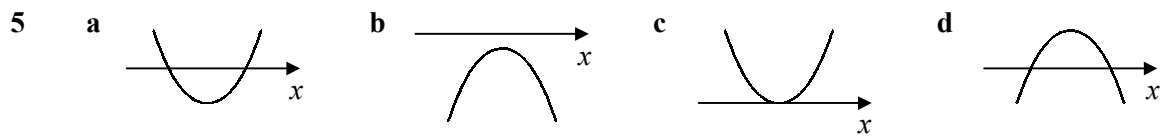
$$x = 1 \pm \frac{1}{2}\sqrt{15}$$

**3**  $2x^2 - 8x + 3 = 0$

$$x = \frac{8 \pm \sqrt{64-24}}{4} = \frac{8 \pm 2\sqrt{10}}{4} = 2 \pm \frac{1}{2}\sqrt{10}$$

$$\therefore (2 - \frac{1}{2}\sqrt{10}, 0) \text{ and } (2 + \frac{1}{2}\sqrt{10}, 0)$$

4 a  $b^2 - 4ac > 0$       b  $b^2 - 4ac = 0$       c  $b^2 - 4ac < 0$



6 a  $b^2 - 4ac = 32$       b  $b^2 - 4ac = -11$       c  $b^2 - 4ac = -4$       d  $b^2 - 4ac = 24$   
 $\therefore$  real and distinct       $\therefore$  not real       $\therefore$  not real       $\therefore$  real and distinct

e  $b^2 - 4ac = 0$       f  $b^2 - 4ac = 13$       g  $b^2 - 4ac = 53$       h  $b^2 - 4ac = -7$   
 $\therefore$  real and equal       $\therefore$  real and distinct       $\therefore$  real and distinct       $\therefore$  not real

i  $b^2 - 4ac = 4$       j  $b^2 - 4ac = -11$       k  $b^2 - 4ac = 0$       l  $b^2 - 4ac = -3$   
 $\therefore$  real and distinct       $\therefore$  not real       $\therefore$  real and equal       $\therefore$  not real

m  $b^2 - 4ac = -7$       n  $b^2 - 4ac = \frac{13}{9}$       o  $b^2 - 4ac = \frac{1}{16}$       p  $b^2 - 4ac = -\frac{13}{75}$   
 $\therefore$  not real       $\therefore$  real and distinct       $\therefore$  real and distinct       $\therefore$  not real

7 equal roots  
 $\therefore b^2 - 4ac = 0$   
 $1 - 4p = 0$   
 $p = \frac{1}{4}$

8 repeated root  
 $\therefore b^2 - 4ac = 0$   
 $4q^2 + 4q = 0$   
 $4q(q + 1) = 0$   
 $q \neq 0 \therefore q = -1$

9  $x^2 + rx - 2x + 4 = 0$  has equal roots  
 $\therefore b^2 - 4ac = 0$   
 $(r - 2)^2 - 16 = 0$   
 $r^2 - 4r - 12 = 0$   
 $(r + 2)(r - 6) = 0$   
 $r = -2$  or  $6$