

Year 12 A-Level Maths

**Answers to Suggested
Questions**



Malmesbury School

Algebraic Simplification

1) Simplify

a) $x + x$ $2x$

b) $x \times x$ x^2

c) $3x + 2x$ $5x$

d) $3x \times 2x$ $6x^2$

e) $2x^2y^3 + 4x^2y^3$ $6x^2y^3$

f) $2x^2y \times 3xy^3$ $6x^3y^4$

2) Simplify

a) $x + y + x + y$ $2x + 2y$

b) $3x + 2y + x + 5y$ $4x + 7y$

c) $6y + 2x - 2y - 3x$ $4y - x$

d) $5p - 3q + p + 2q$ $6p - q$

3) Expand and simplify

a) $2(x + y) + 3(x + y)$
 $5x + 5y$

b) $3(2x + y) + 2(5x + 3y)$
 $16x + 9y$

c) $5(x + y) + 3(2x - y)$
 $11x + 2y$

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

e) $4(2p + q) - 3(2p - q)$
 $2p + 7q$

f) $3(4x - 2y) + 2(x + 2y)$
 $14x - 2y$

g) $6(x - 3y) - 2(2x - 5y)$
 $2x - 8y$

4) Expand and simplify

a) $5(3p + 2) - 2(4p - 3)$
 $7p + 16$

b) $4(2x + 3) - (x - 2)$
 $7x + 14$

5) a) Simplify $pq + 2pq$ $3pq$

b) Simplify $5x + 3y - x - 4y$ $4x - y$

6) a) Simplify $6a + 5b - 3b + a$ $7a + 2b$

b) Simplify $x^4 + x^4$ $2x^4$

7) a) Simplify $x + y + x + y + x$ $3x + 2y$

b) Simplify $t^2 + t^2 + t^2$ $3t^2$

8) a) Simplify $a^3 \times a^3$ a^6

b) Simplify $3x^2y \times 4xy^3$ $12x^3y^4$

9) a) Simplify $3d + e - d + 4e$ $2d + 5e$

b) Simplify $3x^2 - x^2$ $2x^2$

c) Simplify $5t + 8d - 2t - 3d$ $3t + 5d$

d) Simplify $4t \times 2q$ $8tq$

10) The table shows some expressions.

| | | | | |
|------------|---------------|-----------|----------|-----------|
| $2(p + p)$ | $2p \times p$ | $3p + 2p$ | $2 + 2p$ | $2p + 2p$ |
| ✓ | | | | ✓ |

Two of the expressions always have the same value as $4p$.

Tick the boxes underneath the two expressions.

11) Expand and simplify

(i) $4(x + 5) + 3(x - 6)$ $7x + 2$

(ii) $3(2x - 1) - 2(x - 4)$ $4x + 5$

(iii) $5(2y + 2) - (y + 3)$ $9y + 7$

1) Expand these brackets

a) $2(x+3)$ $2x + 6$

b) $3(2x+4)$ $6x + 12$

c) $5(3p-2q)$ $15p - 10q$

d) $4(x^2+2y^2)$ $4x^2 + 8y^2$

e) $r(r-r^2)$ $r^2 - r^3$

2) Expand and simplify

a) $(x+1)(x+2)$ $x^2 + 3x + 2$

b) $(x+3)(2x+4)$ $2x^2 + 10x + 12$

c) $(2x+1)(3x+2)$ $6x^2 + 7x + 2$

3) Expand and simplify

a) $(x+3)(x-2)$ $x^2 + x - 6$

b) $(x-1)(x+4)$ $x^2 + 3x - 4$

c) $(x-3)(x-2)$ $x^2 - 5x + 6$

4) Expand and simplify

a) $(2p+3)(p-2)$ $2p^2 - p - 6$

b) $(3t-2)(2t+3)$ $6t^2 + 5t - 6$

c) $(2x-5)(3x-2)$ $6x^2 - 19x + 10$

5) Expand and simplify

a) $(x+3y)(x+4y)$ $x^2 + 7xy + 12y^2$

b) $(2p+q)(3p+2q)$ $6p^2 + 7pq + 2q^2$

6) Expand and simplify

a) $(2x+1)^2$ $4x^2 + 4x + 1$

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

c) $(2p+q)^2$ $4p^2 + 4pq + q^2$

1) Factorise

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

b) $2y+10$ $2(y+5)$

c) $3x+12$ $3(x+4)$

d) $3x-6$ $3(x-2)$

e) $5x-15$ $5(x-3)$

2) Factorise

a) p^2+7p $p(p+7)$

b) x^2+4x $x(x+4)$

c) y^2-2y $y(y-2)$

d) p^2-5p $p(p-5)$

e) x^2+x $x(x+1)$

3) Factorise

a) $2x^2+6x$ $2x(x+3)$

b) $2y^2-8y$ $2y(y-4)$

c) $5p^2+10p$ $5p(p+2)$

d) $7c^2-21c$ $7c(c-3)$

e) $6x^2+9x$ $3x(2x+3)$

4) Factorise

a) $2x^2-4xy$ $2x(x-2y)$

b) $2t^2+10tu$ $2t(t+5u)$

c) $6x^2-8xy$ $2x(3x-4y)$

d) $3x^2y^2+9xy$ $3xy(xy+3)$

Solve the following equations

$$\begin{aligned} 1) \quad 2p - 1 &= 13 & p &= 7 \\ 2p &= 13 + 1 \\ 2p &= 14 \\ p &= 7 \end{aligned}$$

$$\begin{aligned} 2) \quad 4y + 1 &= 21 & y &= 5 \\ 4y &= 21 - 1 \\ 4y &= 20 \\ y &= 5 \end{aligned}$$

$$\begin{aligned} 3) \quad 6x - 7 &= 32 & x &= 6.5 \\ 6x &= 32 + 7 \\ 6x &= 39 \\ x &= 6.5 \end{aligned}$$

$$\begin{aligned} 4) \quad x + x + x + x &= 20 & x &= 5 \\ 4x &= 20 \\ x &= 5 \end{aligned}$$

$$\begin{aligned} 5) \quad x + 3x &= 40 & x &= 10 \\ 4x &= 40 \\ x &= 10 \end{aligned}$$

$$\begin{aligned} 6) \quad 5(t - 1) &= 20 & t &= 5 \\ 5t - 5 &= 20 \\ 5t &= 20 + 5 \\ 5t &= 25 \\ t &= 5 \end{aligned}$$

$$\begin{aligned} 7) \quad 4(5y - 2) &= 52 & y &= 3 \\ 20y - 8 &= 52 \\ 20y &= 52 + 8 \\ 20y &= 60 \\ y &= 3 \end{aligned}$$

$$\begin{aligned} 8) \quad 4(y + 3) &= 24 & y &= 3 \\ 4y + 12 &= 24 \\ 4y &= 24 - 12 \\ 4y &= 12 \\ y &= 3 \end{aligned}$$

$$\begin{aligned} 9) \quad 20x - 15 &= 18x - 7 & x &= 4 \\ 20x - 18x &= -7 + 15 \\ 2x &= 8 \\ x &= 4 \end{aligned}$$

$$\begin{aligned} 10) \quad 4y + 3 &= 2y + 10 & y &= 3.5 \\ 4y - 2y &= 10 - 3 \\ 2y &= 7 \\ y &= 3.5 \end{aligned}$$

$$\begin{aligned} 11) \quad 2x + 17 &= 5x - 4 & x &= 7 \\ 4 + 17 &= 5x - 2x \\ 21 &= 3x \\ 7 &= x \end{aligned}$$

$$\begin{aligned} 12) \quad 2x + 7 &= 16 - 4x & x &= 1.5 \\ 2x + 4x &= 16 - 7 \\ 6x &= 9 \\ x &= 1.5 \end{aligned}$$

$$\begin{aligned} 13) \quad 5(x + 3) &= 2(x + 6) & x &= -1 \\ 5x + 15 &= 2x + 12 \\ 5x - 2x &= 12 - 15 \\ 3x &= -3 \\ x &= -1 \end{aligned}$$

$$\begin{aligned} 14) \quad 4(2y + 1) &= 2(12 - y) & y &= 2 \\ 8y + 4 &= 24 - 2y \\ 8y + 2y &= 24 - 4 \\ 10y &= 20 \\ y &= 2 \end{aligned}$$

$$\begin{aligned} 15) \quad 7 - 3x &= 2(x + 1) & x &= 1 \\ 7 - 3x &= 2x + 2 \\ 7 - 2 &= 2x + 3x \\ 5 &= 5x \\ 1 &= x \end{aligned}$$

$$\begin{aligned} 16) \quad \frac{x-3}{2} &= 5 & x &= 13 \\ x - 3 &= 5 \times 2 \\ x - 3 &= 10 \\ x &= 13 \end{aligned}$$

$$\begin{aligned} 17) \quad \frac{2x+4}{3} &= 7 & x &= 8.5 \\ 2x + 4 &= 21 \\ 2x &= 17 \\ x &= 8.5 \end{aligned}$$

$$\begin{aligned} 18) \quad \frac{40-x}{3} &= 4 + x & x &= 7 \\ 40 - x &= (4 + x) \times 3 \\ 40 - x &= 12 + 3x \\ 40 - 12 &= 3x + x \\ 28 &= 4x \\ 7 &= x \end{aligned}$$

Indices

| | | |
|---|----------------------------|---|
| 1 a = 64 | b = 216 | c = 1 |
| d = 625 | e = -243 | f = $\frac{1}{16}$ |
| g = $\frac{8}{27}$ | h = $-\frac{1}{64}$ | i = $(\frac{4}{3})^2 = \frac{16}{9}$ or $1\frac{7}{9}$ |
| j = $(\frac{3}{2})^4 = \frac{81}{16}$ or $5\frac{1}{16}$ | k = 0.000 01 | l = -0.008 |

2 **a** 2^8 **b** 2^7 **c** 2^0 **d** 2^4 **e** 2^9 **f** 2^{14}

| | | | |
|----------------------------|----------------------|------------------------------------|----------------------|
| 3 a = $8p^7$ | b = x^{10} | c = $6n^5$ | d = y^{12} |
| e = $2b$ | f = p^4q^3 | g = x^3y | h = $6r^2s^3$ |
| i = $2x^3y^7$ | j = $4a^5b^8$ | k = $125r^3s^6 + 100r^2s^2$ | l = $15p^3q$ |
| | | $= \frac{5}{4}rs^4$ | |

| | | |
|--|--|---|
| 4 a = $\frac{1}{3^2} = \frac{1}{9}$ | b = 1 | c = $\frac{1}{(-2)^6} = \frac{1}{64}$ |
| d = $6^2 = 36$ | e = $(\frac{2}{3})^{-3} = (\frac{3}{2})^3 = \frac{8}{27}$ | f = $\sqrt{9} = 3$ |
| g = $\sqrt[4]{16} = 2$ | h = $\sqrt[3]{-27} = -3$ | i = $\sqrt{\frac{1}{49}} = \frac{1}{7}$ |
| j = $\sqrt[3]{125} = 5$ | k = $\sqrt{\frac{4}{9}} = \frac{2}{3}$ | l = $\frac{1}{\sqrt{36}} = \frac{1}{6}$ |
| m = $\frac{1}{\sqrt[3]{81}} = \frac{1}{3}$ | n = $\frac{1}{\sqrt[3]{-64}} = -\frac{1}{4}$ | o = $\sqrt[5]{32} = 2$ |
| p = $\sqrt[3]{-\frac{8}{125}} = -\frac{2}{5}$ | q = $\sqrt{\frac{9}{4}} = \frac{3}{2}$ or $1\frac{1}{2}$ | r = $(\frac{27}{8})^{-\frac{1}{3}} = \sqrt[3]{\frac{8}{27}} = \frac{2}{3}$ |

| | |
|---|--|
| 5 a = $(\sqrt{4})^3 = 2^3 = 8$ | b = $(\sqrt[3]{27})^2 = 3^2 = 9$ |
| c = $(\sqrt[4]{16})^3 = 2^3 = 8$ | d = $(\sqrt[3]{-125})^2 = (-5)^2 = 25$ |
| e = $(\sqrt{9})^5 = 3^5 = 243$ | f = $\frac{1}{(\sqrt[3]{8})^2} = \frac{1}{2^2} = \frac{1}{4}$ |
| g = $\frac{1}{(\sqrt{36})^3} = \frac{1}{6^3} = \frac{1}{216}$ | h = $(\sqrt[3]{\frac{1}{8}})^4 = (\frac{1}{2})^4 = \frac{1}{16}$ |
| i = $(\sqrt{\frac{4}{9}})^3 = (\frac{2}{3})^3 = \frac{8}{27}$ | j = $(\sqrt[3]{216})^2 = 6^2 = 36$ |
| k = $(\sqrt{\frac{16}{9}})^3 = (\frac{4}{3})^3 = \frac{64}{27}$ or $2\frac{10}{27}$ | l = $(\sqrt[3]{-\frac{27}{64}})^4 = (-\frac{3}{4})^4 = \frac{81}{256}$ |
| m = $\sqrt{\frac{4}{100}} = \frac{2}{10} = \frac{1}{5}$ or 0.2 | n = $(\frac{9}{4})^{-\frac{3}{2}} = (\sqrt{\frac{4}{9}})^3 = (\frac{2}{3})^3 = \frac{8}{27}$ |
| o = $(\sqrt[3]{\frac{64}{1000}})^2 = (\frac{4}{10})^2 = \frac{4}{25}$ or 0.16 | p = $(\frac{25}{16})^{-\frac{1}{2}} = (\sqrt{\frac{16}{25}})^3 = (\frac{4}{5})^3 = \frac{64}{125}$ |
| q = $(\frac{81}{16})^{\frac{3}{4}} = (\sqrt[4]{\frac{81}{16}})^3 = (\frac{3}{2})^3 = \frac{27}{8}$ or $3\frac{3}{8}$ | r = $(\frac{64}{27})^{-\frac{4}{3}} = (\sqrt[3]{\frac{27}{64}})^4 = (\frac{3}{4})^4 = \frac{81}{256}$ |

| | | | | |
|---|--|--|---|---|
| 6 | $a = \sqrt{4} \times \sqrt[3]{27}$ $= 2 \times 3 = 6$ | $b = \sqrt[4]{16} + \sqrt{25}$ $= 2 + 5 = 7$ | $c = \frac{1}{\sqrt[3]{8}} + \sqrt{36}$ $= \frac{1}{2} + 6 = \frac{13}{2}$ | $d = \sqrt[3]{-64} \times (\sqrt{9})^3$ $= -4 \times 27 = -108$ |
| | $e = 3^2 - \sqrt[3]{-8}$ $= 9 - (-2) = 11$ | $f = \sqrt{\frac{1}{25}} \times 4^2$ $= \frac{1}{5} \times 16 = \frac{16}{5}$ or $3\frac{1}{5}$ | $g = (\sqrt[4]{81})^3 - \sqrt{49}$ $= 27 - 7 = 20$ | $h = \sqrt[3]{27} \times (\sqrt{\frac{9}{4}})^3$ $= 3 \times \frac{27}{2} = \frac{81}{2}$ or $40\frac{1}{2}$ |
| | $i = \sqrt{9} \times (\sqrt[3]{-32})^3$ $= 3 \times (-8) = -24$ | $j = \sqrt{121} + \sqrt[5]{32}$ $= 11 + 2 = 13$ | $k = \sqrt{100} + (\sqrt{\frac{1}{4}})^3$ $= 10 + \frac{1}{8} = 10\frac{1}{8}$ | $l = \frac{1}{\sqrt[3]{16}} \times (\sqrt[5]{243})^2$ $= \frac{1}{2} \times 9 = 4\frac{1}{2}$ |
| 7 | $a = x^2$ | $b = y^{-6}$ | $c = 3p^{-4}$ | $d = 8x^{-12}$ |
| | $e = y^{\frac{5}{2}}$ | $f = 8b^{\frac{3}{4} + \frac{1}{4}} = 8b^1$ | $g = x^{\frac{3}{4} - \frac{1}{4}} = x^{\frac{2}{4}} = x^{\frac{1}{2}}$ | $h = a^{\frac{1}{2} - \frac{4}{6}} = a^{-\frac{1}{3}}$ |
| | $i = p^{\frac{1}{2} - (-\frac{1}{2})} = p^1$ | $j = 9x^{\frac{5}{3}}$ | $k = y^{1 + \frac{4}{6} - \frac{3}{2}} = y^1$ | $l = \frac{1}{3}t$ |
| | $m = b^{2 + \frac{1}{4} - \frac{1}{4}} = b^2$ | $n = y^{\frac{1}{2} + \frac{1}{3} - 1} = y^{-\frac{1}{6}}$ | $o = 2x^{\frac{3}{4} + (-\frac{1}{4}) - \frac{3}{4}} = 2x^{-\frac{1}{2}}$ | $p = \frac{1}{4}a^{1 + \frac{1}{2} - (-\frac{1}{2})} = \frac{1}{4}a^2$ |

Manipulating Surds

1. Simplify the following surds

a) $\sqrt{48}$

$4\sqrt{3}$

b) $\sqrt{75}$

$5\sqrt{3}$

c) $\sqrt{147}$

$7\sqrt{3}$

d) $\sqrt{1575}$

$15\sqrt{7}$

2. Write the following surds as simply as possible

a) $2\sqrt{12}$

$4\sqrt{3}$

b) $4\sqrt{24}$

$8\sqrt{6}$

c) $5\sqrt{18}$

$15\sqrt{2}$

d) $2\sqrt{27}$

$6\sqrt{3}$

3. Simplify the following surds

a) $\sqrt{5} + 3\sqrt{5} + 6\sqrt{5}$

$10\sqrt{5}$

b) $5\sqrt{2} + 7\sqrt{2} - 4\sqrt{2} + 5\sqrt{2}$

$13\sqrt{2}$

c) $\sqrt{28} + \sqrt{63} - \sqrt{112}$

$\sqrt{7}$

d) $\sqrt{50} - \sqrt{72} + \sqrt{18} - \sqrt{32}$

$-2\sqrt{2}$

e) $4\sqrt{3} + 5\sqrt{2} - 6\sqrt{2} - 3\sqrt{3}$

$-\sqrt{2} + \sqrt{3}$

f) $\frac{\sqrt{6}}{\sqrt{2}}$

$\sqrt{3}$

g) $\frac{5\sqrt{24}}{2\sqrt{50}}$

$\sqrt{3}$

Rationalising the Denominator

1. Rationalise the denominators on the following expressions

a) $\frac{\sqrt{5}}{\sqrt{20}}$

$$\frac{1}{\sqrt{2}}$$

b) $\frac{2\sqrt{10}}{\sqrt{125}}$

$$\sqrt{2}$$

c) $\frac{12\sqrt{12}}{8\sqrt{6}}$

$$\frac{3\sqrt{2}}{2}$$

d) $\frac{3\sqrt{18}}{4\sqrt{24}}$

$$\frac{9\sqrt{3}}{4}$$

e) $\frac{2\sqrt{8}}{6\sqrt{6}}$

$$\frac{2\sqrt{3}}{9}$$

f) $\frac{4}{8 + \sqrt{20}}$

$$\frac{8 - 2\sqrt{5}}{11}$$

g) $\frac{\sqrt{10} + \sqrt{50}}{\sqrt{5}}$

$$2\sqrt{5}$$

h) $\frac{\sqrt{12} + \sqrt{20}}{\sqrt{5}}$

$$4\sqrt{15}$$

i) $\frac{\sqrt{6}}{\sqrt{5} + \sqrt{2}}$

$$\frac{\sqrt{30} - 2\sqrt{3}}{3}$$

j) $\frac{\sqrt{3} + \sqrt{2}}{\sqrt{3} + \sqrt{2}}$

$$1$$



Simultaneous Equations - answers

Solve the following linear-linear simultaneous equations by the elimination method

1. $4x + y = 25$
 $4x - y = 23$

2. $5m - 2p = 4$
 $3m - 2p = 0$

$$\begin{array}{l} x = 6 \\ y = 1 \end{array}$$

3. $3x + 4y = 41$
 $4x - 5y = 3$

4. $7x + 4y = -3$
 $3y - 2x = 5$

$$\begin{array}{l} m = 2 \\ p = 3 \end{array}$$

5. $3x - 4y = 14$
 $5x + 3y = -54$

$$\begin{array}{l} x = 7 \\ y = 5 \end{array}$$

$$\begin{array}{l} x = -1 \\ y = 1 \end{array}$$

$$\begin{array}{l} x = -6 \\ y = -8 \end{array}$$

Simultaneous Equations - answers

Solve the following linear-non linear simultaneous equations

1. $x^2 + y^2 = 13$
 $y = x + 1$

2. $y = 3x + 11$
 $y = x^2 + 4x + 5$

$$\begin{array}{l} x = 2 \\ y = -3 \end{array}$$

$$\begin{array}{l} x = 2 \\ y = -3 \end{array}$$

3. $y = x^2 + 7x - 10$
 $y = 3x + 11$

4. $x^2 + y^2 = 2$
 $y = 2x + 1$

$$\begin{array}{l} x = 3 \\ y = -7 \end{array}$$

$$\begin{array}{l} x = 0.2 \\ y = -1 \end{array}$$

5. $x^2 + y^2 = 4$
 $y = x + 2$

6. $y = x^2 + 3x + 2$
 $y = 4x + 8$

$$\begin{array}{l} x = 0 \\ y = -2 \end{array}$$

$$\begin{array}{l} x = 3 \\ y = -2 \end{array}$$

7. $xy = 15$
 $y = 2x - 1$

8. $y = 4x + 14$
 $xy = 12$

$$\begin{array}{l} x = 3 \\ y = -2.5 \end{array}$$

$$\begin{array}{l} x = -1.5 \\ y = -2 \end{array}$$

Completing the Square - answers

Complete the square for these expressions

1. $x^2 - 6x + 8$

$$(x - 3)^2 - 1$$

2. $x^2 - 4x + 9$

$$(x - 2)^2 + 5$$

3. $x^2 - 10x - 5$

4. $x^2 + 12x + 6$

$$(x - 5)^2 - 30$$

$$(x + 6)^2 - 30$$

5. $x^2 - 8x + 7$

6. $x^2 - 10x - 2$

$$(x - 4)^2 - 9$$

$$(x - 5)^2 - 27$$

7. $x^2 + 18x - 3$

8. $x^2 + 4x + 6$

$$(x + 9)^2 - 84$$

$$(x + 2)^2 + 2$$

9. $x^2 + 10x + 2$

10. $x^2 + 18x - 1$

$$(x + 5)^2 - 23$$

$$(x + 9)^2 - 82$$

Factorising a Quadratic - answers

1. Factorize the following quadratic equations into double brackets

a) $x^2 + 10x + 24$

$$(x + 4)(x + 6)$$

b) $x^2 + x - 30$

$$(x + 6)(x - 5)$$

c) $x^2 - 11x + 28$

$$(x - 7)(x - 4)$$

2. Factorize the following quadratic equations using the difference of two squares

a) $x^2 - 49$

$$(x + 7)(x - 7)$$

b) $169 - y^2$

$$(13 - y)(13 + y)$$

c) $4x^2 - 9y^2$

$$(2x - 3y)(2x + 3y)$$

d) $25x^2y^2 - 36x^2$

$$(5xy - 6x)(5xy + 6x)$$

3. Factorize the following quadratic equations

a) $4x^2 + 12x + 9$

$$(2x + 3)(2x + 3)$$

b) $3x^2 - 10x - 8$

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

c) $5x^2 + 28x + 15$

$$(5x + 3)(x + 5)$$

Quadratic Formula - answers

Solve the following quadratic equations using the quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ leave your answer in surd form.

1. $x^2 + 5x - 17 = 0$

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

$$\frac{-5 \pm \sqrt{93}}{2}$$

$$\frac{1 \pm \sqrt{113}}{14}$$

3. $2x^2 + 4x - 4 = 0$

4. $5x^2 = x + 2$

$$-1 \pm \sqrt{3}$$

$$\frac{1 \pm \sqrt{41}}{10}$$

5. $3x^2 + 4x = 6$

$$\frac{-2 \pm \sqrt{22}}{3}$$

Solving Quadratic equations - answers

Solve the following quadratic equations

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

$$x = -2, -4$$

2. $(x - 5)(x - 6) = 0$

$$x = 5, 6$$

3. $(x - 7)(x - 4) = 0$

$$x = 4, 7$$

4. $x(x + 7) = 0$

$$x = 0, -7$$

5. $(2x + 3)(x - 8) = 0$

$$x = -1.5, 8$$

6. $(5x - 3)(x + 5) = 0$

$$x = 0.6, -5$$

Solve the following quadratic equations by factorizing first

7. $x^2 - 7x + 12 = 0$

$$x = 3, 4$$

8. $x^2 + 5x - 6 = 0$

$$x = 1, -6$$

9. $x^2 - 2x - 15 = 0$

$$x = 5, -3$$

10. $x^2 + 5x - 24 = 0$

$$x = 3, -8$$

11. $x^2 + 11x + 30 = 0$

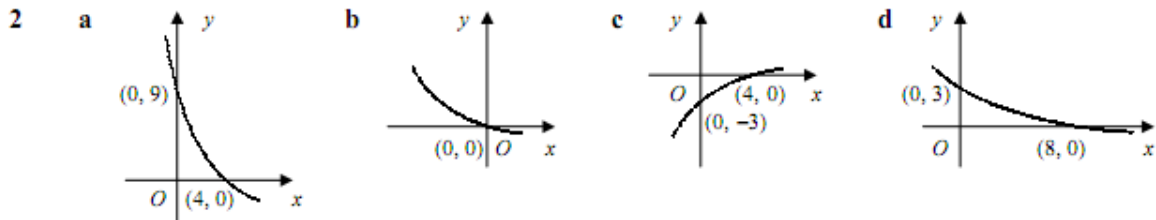
$$x = -5, -6$$

12. $x^2 = 88 - 3x$

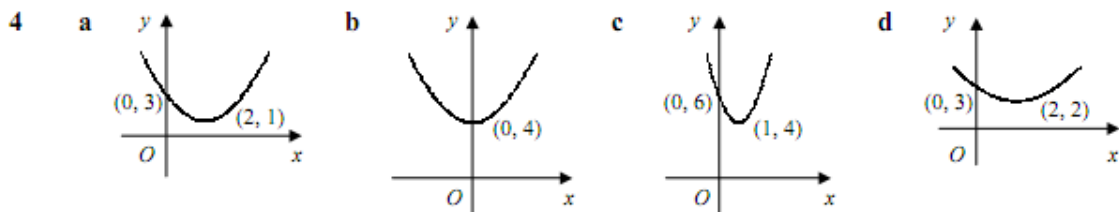
$$x = 8, -11$$

Transforming Graphs

- 1 a translated 1 unit in positive x -direction
 c stretched by a factor of 2 in y -direction
 e reflected in the x -axis
 g reflected in the y -axis
- b translated 3 units in negative y -direction
 d stretched by a factor of $\frac{1}{4}$ in x -direction
 f stretched by a factor of $\frac{1}{5}$ in y -direction
 h stretched by a factor of $\frac{3}{2}$ in x -direction



- 3 a $y = 2x + 5 + 1 \Rightarrow y = 2x + 6$ b $y = 3(1 - 4x) \Rightarrow y = 3 - 12x$
 c $y = 3(x + 4) + 1 \Rightarrow y = 3x + 13$ d $y = -(4x - 7) \Rightarrow y = 7 - 4x$

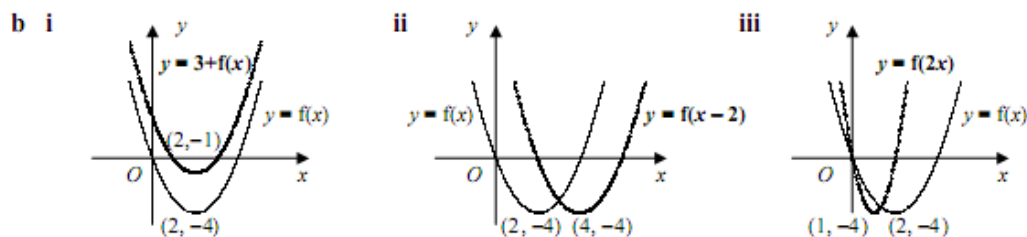


- 5 a stretch by a factor of 4 in y -direction b translation by 2 units in positive x -direction
 c reflection in the x -axis d translation by 5 units in positive y -direction

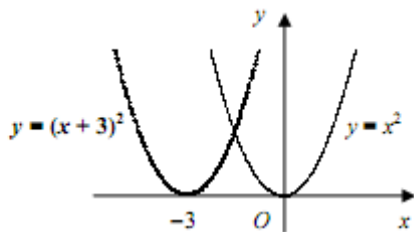
- 6 a $y = 2(x^2 + 2)$ stretch by a factor of 2 in y -direction b $y = (x^2 + 2) - 7$ translation by 7 units in negative y -direction
 c $y = (\frac{1}{3}x)^2 + 2$ stretch by a factor of 3 in x -direction d $y = (x + 2)^2 + 2$ translation by 2 units in negative x -direction

- 7 a $y = (x - 1)^2 + 2(x - 1) \Rightarrow y = x^2 - 1$
 b $y = (3x)^2 - 4(3x) + 5 \Rightarrow y = 9x^2 - 12x + 5$
 c $y = (-x)^2 + (-x) - 6 \Rightarrow y = x^2 - x - 6$
 d $y = 2(\frac{1}{2}x)^2 - 3(\frac{1}{2}x) \Rightarrow y = \frac{1}{2}x^2 - \frac{3}{2}x$

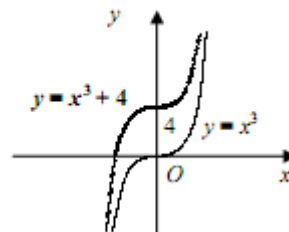
- 8 a $f(x) = (x - 2)^2 - 4 \therefore$ turning point $(2, -4)$



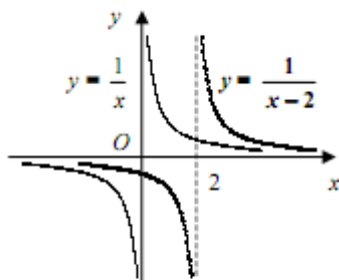
9 a



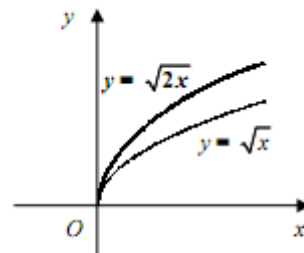
b



c



d



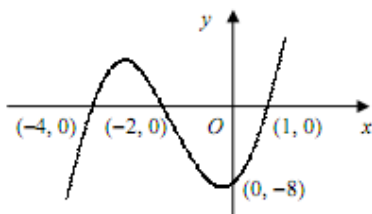
10 a let $f(x) = \frac{1}{x} \therefore \frac{1}{3x} = \frac{1}{3} f(x)$ or $f(3x)$

\therefore stretch by a factor of $\frac{1}{3}$ in y -direction
or stretch by a factor of $\frac{1}{3}$ in x -direction

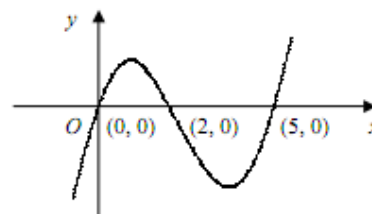
b let $g(x) = x^2 \therefore 4x^2 = 4g(x)$ or $g(2x)$

\therefore stretch by a factor of 4 in y -direction
or stretch by a factor of $\frac{1}{2}$ in x -direction

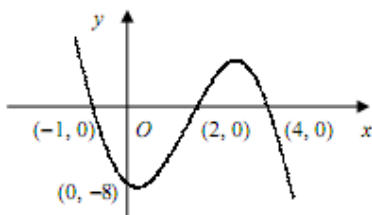
11 a



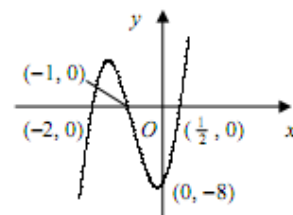
b



c



d



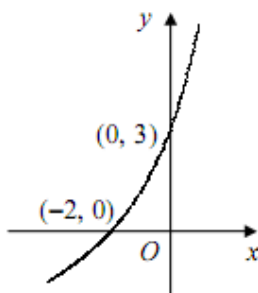
12 a $(a, 3b)$

b $(a, b+4)$

c $(a-1, b)$

d $(3a, b)$

13 a



b

