



Solving Quadratic Equations by Factorising.



A. Solve these equations.

- | | | | |
|------------------------|------------------------|------------------------|------------------------|
| 1). $x(x - 4) = 0$ | 2). $f(f - 7) = 0$ | 3). $2a(a - 3) = 0$ | 4). $3a(a - 6) = 0$ |
| 5). $s(s + 2) = 0$ | 6). $p(p + 5) = 0$ | 7). $4y(y + 1) = 0$ | 8). $5p(p + 4) = 0$ |
| 9). $3g(2g - 5) = 0$ | 10). $5b(2b - 7) = 0$ | 11). $4t(3t - 7) = 0$ | 12). $2a(5a - 9) = 0$ |
| 13). $2x(3x + 10) = 0$ | 14). $4z(5z + 17) = 0$ | 15). $3m(2m + 11) = 0$ | 16). $5n(4n + 18) = 0$ |
| 17). $7h(2h - 9) = 0$ | 18). $3f(f + 11) = 0$ | 19). $4u(u - 7) = 0$ | 20). $6f(4f + 21) = 0$ |

B. Factorise the following to solve each quadratic equation.

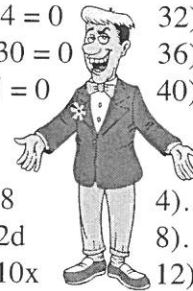
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|------------------------|------------------------|-----------------------|------------------------|
| 1). $x^2 - 5x = 0$ | 2). $a^2 + 6a = 0$ | 3). $b^2 - 9b = 0$ | 4). $n^2 + 7n = 0$ |
| 5). $k^2 - 8k = 0$ | 6). $x^2 + 12x = 0$ | 7). $d^2 + 16d = 0$ | 8). $p^2 - 3p = 0$ |
| 9). $3v^2 - 21v = 0$ | 10). $4q^2 - 20q = 0$ | 11). $5x^2 + 35x = 0$ | 12). $3a^2 + 18a = 0$ |
| 13). $6f^2 - 9f = 0$ | 14). $4k^2 + 10k = 0$ | 15). $9e^2 + 15e = 0$ | 16). $21w^2 + 35w = 0$ |
| 17). $18h^2 - 42h = 0$ | 18). $10c^2 - 45c = 0$ | 19). $8y^2 - 28y = 0$ | 20). $15u^2 + 55u = 0$ |

C. Solve these equations.

- | | | | |
|---------------------------|---------------------------|---------------------------|---------------------------|
| 1). $(x + 3)(x + 4) = 0$ | 2). $(f + 6)(f + 3) = 0$ | 3). $(a + 2)(a + 5) = 0$ | 4). $(a + 2)(a + 7) = 0$ |
| 5). $(s - 3)(s - 4) = 0$ | 6). $(p - 2)(p - 7) = 0$ | 7). $(y - 8)(y - 1) = 0$ | 8). $(p - 2)(p - 9) = 0$ |
| 9). $(g + 4)(g - 3) = 0$ | 10). $(b + 6)(b - 4) = 0$ | 11). $(t + 2)(t - 7) = 0$ | 12). $(a + 6)(a - 5) = 0$ |
| 13). $(x - 4)(x + 2) = 0$ | 14). $(z - 7)(z + 1) = 0$ | 15). $(m - 3)(m + 9) = 0$ | 16). $(n - 7)(n + 3) = 0$ |
| 17). $(h - 2)(h - 4) = 0$ | 18). $(f - 3)(f + 6) = 0$ | 19). $(u + 2)(u + 5) = 0$ | 20). $(f + 4)(f - 4) = 0$ |

D. Factorise first, then solve these equations.

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|---------------------------|---------------------------|---------------------------|----------------------------|
| 1). $x^2 + 5x + 4 = 0$ | 2). $a^2 + 7a + 12 = 0$ | 3). $b^2 + 10b + 9 = 0$ | 4). $n^2 + 10n + 21 = 0$ |
| 5). $k^2 + 8k + 12 = 0$ | 6). $x^2 + 9x + 18 = 0$ | 7). $d^2 + 10d + 24 = 0$ | 8). $p^2 + 18p + 81 = 0$ |
| 9). $v^2 - 6v + 8 = 0$ | 10). $q^2 - 8q + 15 = 0$ | 11). $x^2 - 6x + 5 = 0$ | 12). $a^2 - 9a + 20 = 0$ |
| 13). $f^2 - 15f + 36 = 0$ | 14). $k^2 - 16k + 48 = 0$ | 15). $e^2 - 13e + 36 = 0$ | 16). $w^2 - 17w + 72 = 0$ |
| 17). $h^2 + 4h - 12 = 0$ | 18). $c^2 + 2c - 24 = 0$ | 19). $y^2 + 10y - 11 = 0$ | 20). $u^2 + 3u - 18 = 0$ |
| 21). $m^2 + m - 56 = 0$ | 22). $r^2 + 4r - 21 = 0$ | 23). $c^2 + 7c - 60 = 0$ | 24). $v^2 + 13v - 48 = 0$ |
| 25). $g^2 - 14g - 15 = 0$ | 26). $s^2 - s - 72 = 0$ | 27). $e^2 - e - 2 = 0$ | 28). $t^2 - 3t - 10 = 0$ |
| 29). $x^2 - 2x - 15 = 0$ | 30). $d^2 - 10d - 24 = 0$ | 31). $z^2 - 20z - 44 = 0$ | 32). $p^2 - 18p - 144 = 0$ |
| 33). $a^2 + 11a + 18 = 0$ | 34). $f^2 - 18f + 72 = 0$ | 35). $y^2 + 13y - 30 = 0$ | 36). $w^2 - 8w + 16 = 0$ |
| 37). $j^2 - 26j + 48 = 0$ | 38). $g^2 - 15g + 54 = 0$ | 39). $n^2 - 2n - 35 = 0$ | 40). $x^2 + 25x + 154 = 0$ |



E. First rearrange, then factorise to finally solve these equations.

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|-----------------------|------------------------|------------------------|-----------------------|
| 1). $x^2 + 11x = -18$ | 2). $a^2 + 6a = 16$ | 3). $b^2 + 2b = 48$ | 4). $n^2 - 9n = -8$ |
| 5). $k^2 + 22 = 13k$ | 6). $x^2 + 35 = 12x$ | 7). $d^2 - 35 = -2d$ | 8). $p^2 - 48 = -2p$ |
| 9). $v^2 + 2v = 15$ | 10). $q^2 - 24 = 5q$ | 11). $x^2 + 16 = -10x$ | 12). $a^2 - 3a = -2$ |
| 13). $f^2 = 11f - 18$ | 14). $k^2 = 2k + 35$ | 15). $e^2 = 54 - 3e$ | 16). $w^2 = 17w - 30$ |
| 17). $12 - 7h = -h^2$ | 18). $10c - 24 = -c^2$ | 19). $18 - 3y = y^2$ | 20). $144 - 7u = u^2$ |

F. Solve these equations.

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|-----------------------------|------------------------------|-----------------------------|------------------------------|
| 1). $(2x + 5)(x + 7) = 0$ | 2). $(f + 4)(3f + 10) = 0$ | 3). $(2a + 7)(a + 3) = 0$ | 4). $(4a + 9)(a + 4) = 0$ |
| 5). $(3s - 4)(s - 6) = 0$ | 6). $(2p - 7)(p - 2) = 0$ | 7). $(5y - 1)(y - 6) = 0$ | 8). $(p - 6)(3p - 14) = 0$ |
| 9). $(2g - 9)(g + 4) = 0$ | 10). $(b - 3)(4b + 3) = 0$ | 11). $(t + 4)(5t - 4) = 0$ | 12). $(3a + 7)(a - 2) = 0$ |
| 13). $(2x - 4)(3x + 7) = 0$ | 14). $(3z + 2)(2z - 11) = 0$ | 15). $(4m - 3)(5m + 9) = 0$ | 16). $(2n - 15)(5n + 8) = 0$ |

G. Solve these equations.

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|----------------------------|---------------------------|----------------------------|---------------------------|
| 1). $2x^2 + 5x + 3 = 0$ | 2). $2a^2 + 7a + 5 = 0$ | 3). $3b^2 + 5b + 2 = 0$ | 4). $5n^2 + 26n + 5 = 0$ |
| 5). $7x^2 - 8x + 1 = 0$ | 6). $2k^2 - 13k + 11 = 0$ | 7). $2d^2 - 11d + 15 = 0$ | 8). $3p^2 - 19p + 28 = 0$ |
| 9). $3v^2 + 14v - 5 = 0$ | 10). $2q^2 + q - 3 = 0$ | 11). $5x^2 + 2x - 7 = 0$ | 12). $3a^2 + 4a - 7 = 0$ |
| 13). $2f^2 - f - 28 = 0$ | 14). $5k^2 - 9k - 2 = 0$ | 15). $3e^2 - 13e - 10 = 0$ | 16). $2w^2 - 5w - 18 = 0$ |
| 17). $7h^2 - 38h + 15 = 0$ | 18). $5c^2 - 16c + 3 = 0$ | 19). $4y^2 - 20y + 25 = 0$ | 20). $6u^2 + u - 12 = 0$ |



Plotting Quadratic Equations.



- 1). a). Copy and complete the table below for $y = x^2 + 3x - 4$ for the values $-7 \leq x \leq 4$.

x	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4
x^2				16	9	4				4		
$+3x$		-18					-3				9	
-4	-4	-4	-4	-4								
y	24					-6						

- b). Plot the graph of $y = x^2 + 3x - 4$ for the values $-7 \leq x \leq 4$. (The scale on the y-axis must go between the biggest number in the table and the lowest).
 c). **Use the graph** to find the values of x when y is i). 10 ii). -3 iii). 20.
- 2). a). Copy and complete the table below for $y = x^2 - 2x + 3$ for the values $-4 \leq x \leq 6$.

x	-4	-3	-2	-1	0	1	2	3	4	5	6
x^2			4				4		16		
$-2x$	8					-2					-12
$+3$	+3	+3	+3	+3	+3						
y	27			6							

- b). Plot the graph of $y = x^2 - 2x + 3$ for the values $-4 \leq x \leq 6$.
 c). **Use the graph** to find the values of x when y is i). 25 ii). 4 iii). 13.
- 3). a). Copy and complete the table below for $y = x^2 - 2x - 6$ for the values $-4 \leq x \leq 6$.

x	-4	-3	-2	-1	0	1	2	3	4	5	6
x^2			4	1				9			
$-2x$		6									
-6	-6										
y					-6						



- b). Plot the graph of $y = x^2 - 2x - 6$ for the values $-4 \leq x \leq 6$.
 c). **Use the graph** to find the values of x when y is i). 8 ii). -5 iii). 15.
- 4). a). Copy and complete the table below for $y = x^2 - 4x + 8$ for the values $-3 \leq x \leq 7$.

x	-3	-2	-1	0	1	2	3	4	5	6	7
y		20					5				

- b). Plot the graph of $y = x^2 - 4x + 8$ for the values $-3 \leq x \leq 7$.
 c). **Use the graph** to find the values of x when y is i). 6 ii). 10 iii). 25.

- 5). a). Copy and complete the table below for $y = x^2 + 2x - 7$ for the values $-6 \leq x \leq 4$.

x	-6	-5	-4	-3	-2	-1	0	1	2	3	4
y				-4				-4			

- b). Plot the graph of $y = x^2 + 2x - 7$ for the values $-6 \leq x \leq 4$.
 c). **Use the graph** to find the values of x when y is i). 0 ii). 15 iii). -2.



- 6). a). Copy and complete the table below for $y = 2x - x^2$ for the values $-4 \leq x \leq 6$.

x	-4	-3	-2	-1	0	1	2	3	4	5	6
y	-24										



- b). Plot the graph of $y = 2x - x^2$ for the values $-4 \leq x \leq 6$.
 c). **Use the graph** to find the values of x when y is i). -20 ii). -10 iii). -2.
- 7). a). Copy and complete the table below for $y = 1 - 2x - x^2$ for the values $-6 \leq x \leq 4$.

x	-6	-5	-4	-3	-2	-1	0	1	2	3	4
y											

- b). Plot the graph of $y = 1 - 2x - x^2$ for the values $-6 \leq x \leq 4$.
 c). **Use the graph** to find the values of x when y is i). -20 ii). 0 iii). -9.
- 8). a). Copy and complete the table below for $y = 3x - 12 - x^2$ for the values $-4 \leq x \leq 7$.

x	-4	-3	-2	-1	0	1	2	3	4	5	6	7
y												

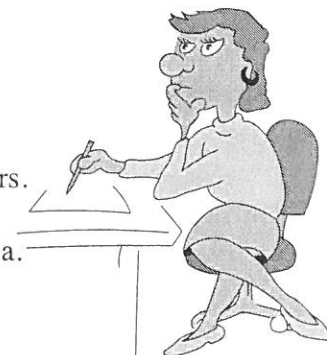
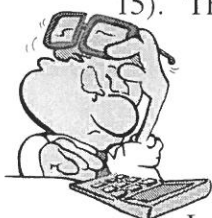
- b). Plot the graph of $y = 3x - 12 - x^2$ for the values $-4 \leq x \leq 7$.
 c). **Use the graph** to find the values of x when y is i). -13 ii). -35 iii). -20.
- 9). a). Draw out a table and plot the graph of $y = 2x^2 - 10$ for the values $-5 \leq x \leq 5$.
 b). **Use the graph** to find the values of x when y is i). 20 ii). -5 iii). 32.
- 10). a). Draw out a table and plot the graph of $y = 2x^2 - x + 5$ for the values $-4 \leq x \leq 5$.
 b). **Use the graph** to find the values of x when y is i). 30 ii). 22 iii). 10.
- 11). a). Draw out a table and plot the graph of $y = \frac{1}{2}x^2 + 3x - 4$ for the values $-8 \leq x \leq 2$.
 b). **Use the graph** to find the values of x when y is i). 2 ii). -2 iii). 0.
- 12). a). Draw out a table and plot the graph of $y = 3x + 10 - 2x^2$ for the values $-3 \leq x \leq 5$.
 b). **Use the graph** to find the values of x when y is i). 7 ii). -16 iii). 0.
- 13). a). Draw out a table and plot the graph of $y = 10 - \frac{1}{2}x^2$ for the values $-5 \leq x \leq 5$.
 b). **Use the graph** to find the values of x when y is i). 9 ii). -1 iii). 4.
- 14). a). Draw out a table and plot the graph of $y = 5 + 3x - \frac{1}{4}x^2$ for the values $1 \leq x \leq 11$.
 b). **Use the graph** to find the values of x when y is i). 8 ii). 13.5 iii). 9.

- 15). The general equation for a quadratic is

$$y = ax^2 + bx + c,$$

where a, b and c are numbers.

Investigate what the effect of changing these numbers has on the parabola.
 You may find looking back at the graphs for this sheet helpful.

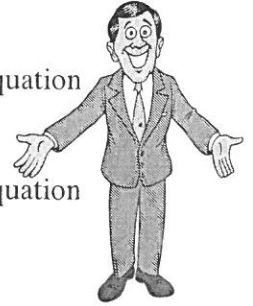




Trial and Improvement.



- 1). Use the trial and improvement method to find the **square root of 30 to two decimal places**. Show all your working clearly.
- 2). Use the method of trial and improvement to find the positive solution to the equation $x^2 - 2x = 6$. **Start with $x = 3$** and find the answer to **2 d.p.**.
- 3). Use the method of trial and improvement to find the positive solution to the equation $f^2 - 5f = 3$. **Start with $x = 6$** and find the answer to **2 d.p.**.
- 4). Use the method of trial and improvement to find the positive solution to the equation $2p^2 - 5p - 10 = 0$. **Start with $p = 3$** and find the answer to **2 d.p.**.
- 5). Use the method of trial and improvement to find the positive solution to the equation $x^2 = 12x - 5$. **Start with $x = 12$** and find the answer to **2 d.p.**.
- 6). A number x satisfies the equation $x^3 = 35$.
 - a). Between which two whole numbers does x lie ?
 - b). Use the method of trial and improvement to find the solution of $x^3 = 35$ to **1 d.p.**.
- 7). Use the method of trial and improvement to find a solution to the equation $k^3 + k = 100$. **Start with $k = 6$** and find the answer to **2 d.p.**.
- 8). Use the method of trial and improvement to find a solution to the equation $x^3 - x = 300$. **Start with $x = 9$** and find the answer to **1 d.p.**.
- 9). A solution of the equation $a^3 + a = 12$ lies between 2 and 3. Use the method of trial and improvement to find the solution of $a^3 + a = 12$ to **1 d.p.**.
- 10). Use the method of trial and improvement to find a solution to the equation $n^3 - n = 35$. **Start with $n = 4$** and find the answer to **2 d.p.**.
- 11). Use the method of trial and improvement to find a solution to the equation $h^3 - 5h = 15$. **Start with $h = 3$** and find the answer to **2d.p.**.
- 12). Use the method of trial and improvement to find a solution to the equation $x^3 + 3x - 20 = 0$. **Start with $x = 2$** and find the answer to **1 d.p.**.
- 13). There are two solutions for the equation $x - \frac{1}{x} = 6$.
Use trial and improvement to find these solutions.
 - a). **Start with $x = 5$** and find the answer to **2 d.p.**
 - b). **Start with $x = -5$** and find the answer to **2 d.p.**
- 14). A solution of the equation $a^2 - \frac{1}{a} = 18$ lies between 4 and 5.
Use the method of trial and improvement to find this solution to **2 d.p.**.
- 15). A solution of the equation $h^3 - \frac{1}{h} = 40$ lies between 3 and 4.
Use the method of trial and improvement to find this solution to **2 d.p.**.





Four in a Row (Quadratics).



Shuffle the pack of cards and place them face down on the table.

Take it in turn to pick the top card.

Factorise it (i.e. put it into two brackets).

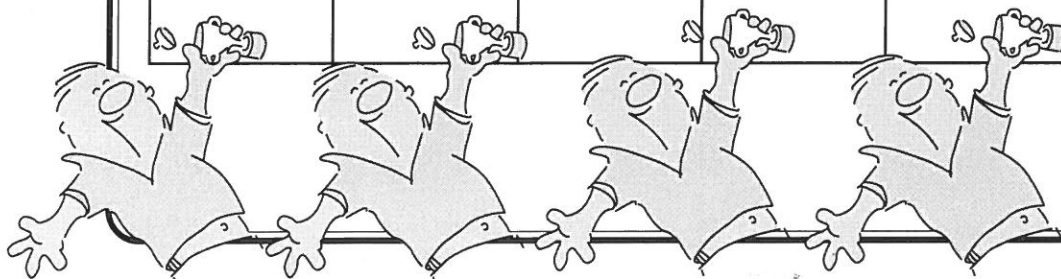
If one of the factors is in a square you can cover it up with your colour counter.

You can only **cover one square each turn.**

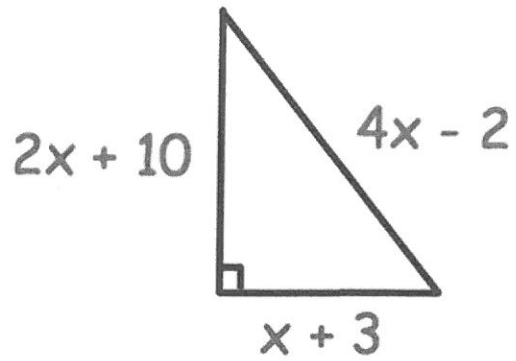
Put your card at the bottom of the pack.

The winner is the first person to get **4** counters in a line in any direction.

$x - 3$	$2x + 3$	$x - 3$	$x + 3$	$2x - 3$	$x - 5$
$x + 1$	$x - 4$	$3x - 2$	$2x + 1$	$x - 2$	$x + 1$
$3x + 2$	$x - 2$	$x + 4$	$x - 6$	$3x + 1$	$2x - 2$
$x + 2$	$x - 1$	$2x - 1$	$3x - 1$	$x + 5$	$x - 1$
$2x + 2$	$x + 3$	$x + 6$	$x - 2$	$3x - 4$	$x + 2$



23.



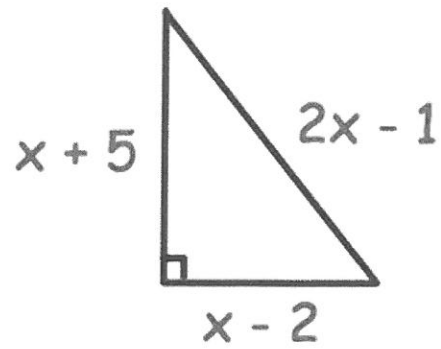
Shown is a right angled triangle.

Show that $11x^2 - 62x - 105 = 0$

(4)



24.



Shown is a right angled triangle with sides are measured in centimetres.

(a) Show that $x^2 - 5x - 14 = 0$

(4)

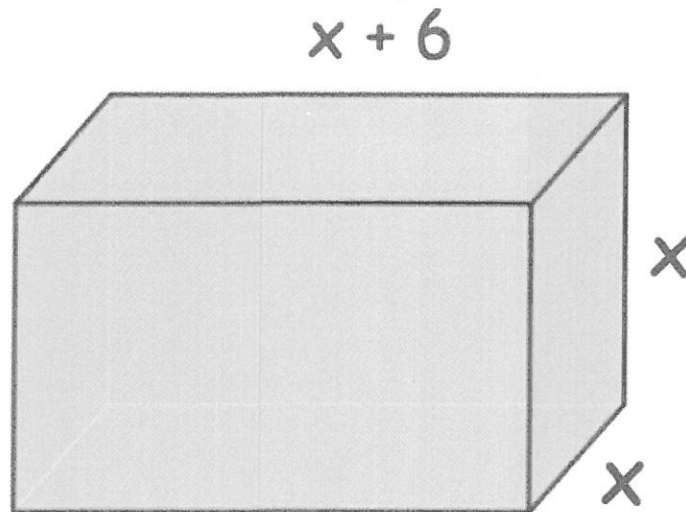
(b) Find x .

.....cm
(2)

(c) Find the area of the triangle.

.....cm²
(1)

25.



The surface area of the cuboid is 270cm^2 .

(a) Show $x^2 + 4x - 45 = 0$

(4)

(b) Find x .

.....cm
(2)

(c) Find the volume of the cuboid.

..... cm^2
(1)

26. Solve

$$\frac{25}{m+3} = m+3$$

m = or m =
(2)

27. A wire of length 20cm is cut into **two** pieces, each of which is bent into a square.

(a) If the length of the side of one square is x cm, show that the length of the side of the other square is (5 - x) cm.

(2)

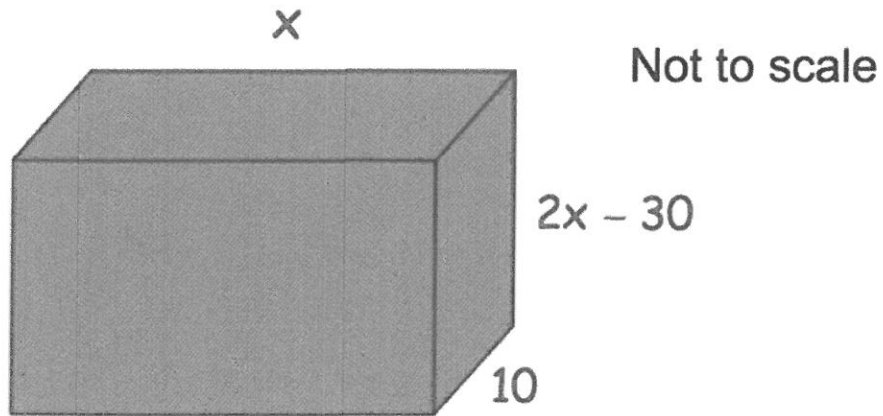
The **total** area of the two squares is 14.5cm².

(b) Find the lengths of the two pieces of wire.

..... andcm
(4)



28. The diagram shows a cuboid.
The volume of the cuboid is 5000cm^3 .



(a) Show $2x^2 - 30x - 500 = 0$

(3)

(b) Solve $2x^2 - 30x - 500 = 0$ to find x , the length of the cuboid.

.....cm
(3)