A Consecutive Numbers

1 Consecutive numbers are whole numbers that follow each other on the number line, for instance 5, 6, 7.

a) Of 3 consecutive numbers, the first one is x. Write an expression for the second and third number.

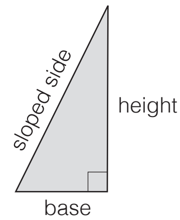
first ……x…… ; second ………………………………………… third …………………………………………

b) Write a formula for the sum, S, of the three consecutive numbers. Simplify the formula.

$S =$ ……

B Right-Angled Triangles

1 In this right-angled triangle the base has length x. The height is twice the base length. The sloped side is 4 cm longer than the height.



a) Write an expression for the height and sloped side.

height …………………………………… ; sloped side ……………………………………

b) Express the perimeter, P, in terms of x. Simplify.

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c) The area of a triangle is found with the formula : Area $= \frac{\text{base x height}}{2}$

Express the area, A, of this triangle in terms of x. Simplify.

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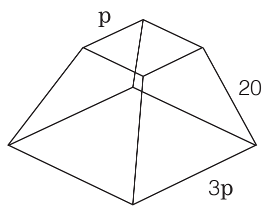
C Lamp Shades

1 Chantelle Lamps Ltd. produce a new series of lampshades. The shape is shown in the diagram. The top square has edges of p cm, the edges of the bottom square are 3 times as long. The sloped edges connecting the 2 squares are 20 cm long. Help the factory foreman by writing an expression for the amount of wire, w, needed for the lampshade. Simplify the expression.



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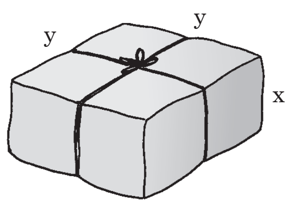
2 Chantelle Lamps pack the lamps in cardboard boxes. A string is tied around the boxes as shown, 30 cm of string is used for the knot. Write and simplify an expression for the length of string, L, needed to go around a box.



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D A Business Lunch

1 Amy, Ben and Caleb are having a business lunch. Ben's lunch costs 40% more than Amy's. Caleb's lunch costs $5 less than Ben's. Express the total cost of the lunch for three in terms of A (Amy's lunch).

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A Using a Formula

1 The circumference of a circle can be found with the formula $C = \pi d$, where d is the diameter.

a) Calculate the circumference of a circle with diameter 5 m.

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b) A circle has a circumference of 314 m.
Calculate the diameter by solving $314 = \pi d$.

....

The formula $C = \pi d$ is most useful when you know d and you wish to calculate C. C is the **subject** of the formula.
If you know C and you wish to calculate d, it is handy to rearrange the formula and make d the subject : $d = \frac{C}{\pi}$.

2 The perimeter of a rectangle can be found with the formula $P = 2(b + h)$.

a) Calculate the perimeter of a rectangle with base 10.3 cm and height 4.6 cm.

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b) A rectangle has a perimeter of 18 cm and height 3.5 cm.
Calculate the base by solving $18 = 2(b + 3.5)$.

....

....

c) Rearrange this formula to make it easy to calculate b, when P and h are known.

$2(b + h) = P$

....

$b =$ ....

3 The area of a triangle can be found with the formula $A = \frac{bh}{2}$.

a) A triangle has an area of 27 cm^2 and the base is 6 cm.
Calculate the height by solving $27 = \frac{6h}{2}$.

....

b) Rearrange the formula to make h the subject.

$\frac{bh}{2} = A$

....

$h =$ ....

B Changing the Subject

Examples : a) Make p the subject of the equation $ap - 3 = u$
b) Make r the subject of the formula $V = \pi r^2 h$

Working : a)
$$ap - 3 = u$$
$$ap = u + 3$$
$$p = \frac{u+3}{a}$$

b)
$$\pi r^2 h = V$$
$$r^2 = \frac{V}{\pi h}$$
$$r = \sqrt{\frac{V}{\pi h}}$$

1 Make p the subject of these equations.

a) $2a + p = 5$

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....

b) $4p - m = a$

....

....

c) $\frac{ap}{b} = 3$

....

....

d) $p^2 + q^2 = r^2$

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2a) $I = \frac{PRT}{100}$
Make R the subject

....

....

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....

b) $t = a + (n - 1)d$
Make d the subject

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3 $E = \frac{1}{2}mv^2$

a) Make m the subject

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b) Make v the subject

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4 The formula for area of a trapezium is $A = \frac{1}{2}(a + b)h$

a) Make h the subject.

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b) Make b the subject.

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  ISBN 978-1-877567-53-7.

A Read and Solve

1 A series of squares is produced in such a way that the first square has an area of 3 cm^2, the second square an area of 6 cm^2 and each following square has an area twice as large as the previous. The nth square has an area of $A = 3(2^{n-2})$.

Use the formula to work out how many squares need to be produced to get one with an area of 192 cm^2.

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2 Dylan and his friends have bought tickets to see a movie. Dylan worked out that with the money left in his wallet he can buy a soft drink and he will have $2 left over. But with an extra $7 he can buy 3 soft drinks and popcorn for $4.

a) Use M for the amount of money in Dylan's wallet and D for the cost of a drink to write two equations.

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b) How much money has Dylan in his wallet?

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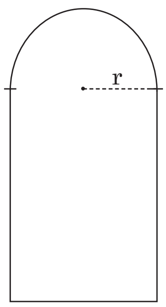
3 A rectangle is twice as long as it is wide. A semi-circle fits exactly on the width of the rectangle as shown.



a) Express the perimeter (P) of the shape in terms of r, the radius of the circle.

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b) Make r the subject of the formula.

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B Money, Money, Money

1 Trixie went to the ten-pin bowling alley with her friends. The outing cost her $30 in total.

Trixie needed bowling shoes which cost 10% of the price of a game. She also paid $6 for refreshments. Since the second game was half price Trixie decided to play two games.

a) Write an equation for this information. Use $$x$ for the price of one game.

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b) Calculate the price of one game.

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2 Adam and Ben work for the same company. Together their weekly wages come to $1800. Next week the young men will get a wage increase - Adam $150, Ben $140. By then Adam earns in 6 weeks what Ben earns in 5 weeks.

Calculate Adam's weekly wages before the increase.

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A Two Solutions

A **quadratic equation** is an equation in which the variable appears in squared form.

Examples of quadratic equations :

$x^2 = 16$, $n^2 - 4 = 5$, $a^2 - 2a = 15$

Quadratic equations often have two solutions.

Example : The solutions of $x^2 = 16$ are $x = 4$ or $x = {}^-4$

Check : $4^2 = 4 \times 4 = 16$

$({}^-4)^2 = {}^-4 \times {}^-4 = 16$

Note the brackets around $({}^-4)^2$; ${}^-4^2$ is not the same as $({}^-4)^2$.

1a) The solutions to $n^2 - 4 = 5$ are $n = 3$ or $n = {}^-3$.

Check: ……………………………………………………………

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b) The solutions to $a^2 - 2a = 15$ are $a = 5$ or $a = {}^-3$.

Check: ……………………………………………………………

……………………………………………………………

c) The solutions to $2y^2 - y = 0$ are $y = 0$ or $y = 0.5$

Check: ……………………………………………………………

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2 Find two solutions for each of these quadratic equations.

a) $p^2 = 25$ $\Rightarrow$ $p =$ ……….. or $p =$ ………..

b) $a^2 + 1 = 50$ $\Rightarrow$ $a =$ ……….. or $a =$ ………..

c) $x^2 - 4 = 0$ $\Rightarrow$ $x =$ ……….. or $x =$ ………..

d) $3y^2 = 48$ $\Rightarrow$ $y =$ ……….. or $y =$ ………..

3 Find at least one solution for these quadratic equations.

a) $n^2 + n = 2$ $\Rightarrow$ $n =$ ……………………………

b) $a^2 - 6a = 16$ $\Rightarrow$ $a =$ ……………………………

c) $t^2 + 8t = 105$ $\Rightarrow$ $t =$ ……………………………

d) $x^2 + 15x = 100$ $\Rightarrow$ $x =$ ……………………………

4 Do you think $(x + 3)(x - 5) = 0$ is a quadratic equation?

Explain ……………………………………………………………

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B Two Sets of Brackets

The equation $(x + 3)(x - 2) = 0$ is also a quadratic equation.
We can find the two solutions with the **guess and check** method.

guess	check			
$x = 3$	$(3 + 3) \times (3 - 2)$	$= 6 \times 1$	$= 6$	✗
$x = 2$	$(2 + 3) \times (2 - 2)$	$= 5 \times 0$	$= 0$	✓
$x = 1$	$(1 + 3) \times (1 - 2)$	$= 4 \times {}^-1$	$= {}^-4$	✗
$x = 0$	$(0 + 3) \times (0 - 2)$	$= 3 \times {}^-2$	$= {}^-6$	✗
$x = {}^-1$	$({}^-1 + 3) \times ({}^-1 - 2)$	$= 2 \times {}^-3$	$= {}^-6$	✗
$x = {}^-2$	$({}^-2 + 3) \times ({}^-2 - 2)$	$= 1 \times {}^-4$	$= {}^-4$	✗
$x = {}^-3$	$({}^-3 + 3) \times ({}^-3 - 2)$	$= 0 \times {}^-5$	$= 0$	✓

The solutions to $(x + 3)(x - 2) = 0$ are $x = {}^-3$ or $x = 2$

1 Find the two solutions for these quadratic equations. Check!

a) $(x - 1)(x - 2) = 0$ $\Rightarrow$ $x =$ ……….. or $x =$ ………..

b) $(n + 1)(n - 4) = 0$ $\Rightarrow$ $n =$ ……….. or $n =$ ………..

c) $(p + 2)(p + 3) = 0$ $\Rightarrow$ $p =$ ……….. or $p =$ ………..

d) $y(y + 3) = 0$ $\Rightarrow$ $y =$ ……….. or $y =$ ………..

Problem : We multiply two numbers and the result is zero.
What does this tell us about the two numbers?

Answer : One of the numbers must be zero.
This fact is used when we solve factorised equations.

Example : Solve $(2x + 3)(x - 4) = 0$

Working : either $2x + 3 = 0$ or $x - 4 = 0$

$2x = {}^-3$ or $x = 4$

Solution : either $x = {}^-1.5$ or $x = 4$

2 Solve

a) $(3x - 6)(x + 1) = 0$

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b) $(2x + 5)(x - 2) = 0$

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c) $x(2x - 1) = 0$

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