



Grade 9

NUMBER SENSE AND NUMERATION: EQUATIONS AND INEQUATIONS

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Play **Planet Blast Game** first.

Click on <http://www.aplusmath.com/Games/PlanetBlast/index.html> to play.

You may also go to www.wiredmath.ca for the link.

Solving Equations by Balancing

- Think of the equation as an equal-arm balance.
- Perform the same operation on both sides of an equation.
- Check your solution by substituting the answer into the left and right sides of the given equation.



1. Solve the following equations by balancing. Check your answers by substitution.

a. $x - 4 = 6$

b. $-2 = -5 + y$

c. $4 + z + 6 = -8 - 12$

d. $4x + 5 = 17$

e. $7r + 57 = -13$

f. $28 - 5x = 4x + 8$

g. $y - 4\frac{1}{2} = -3\frac{2}{3}$

h. $2.3 + x - 4.1 = 8.5$

i. $3.8 - 0.6d = 8.3 + 0.9d$

j. $2(3a + 8) - 11 = 7$

k. $9(-0.7b + 3) - 1.1 = 7$

l. $5(y - 2) - 3(y + 4) = -9y$

m. $\frac{x}{4} = -3$

n. $\frac{2x}{3} = 6$

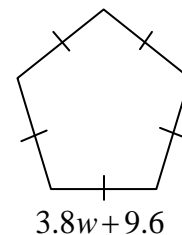
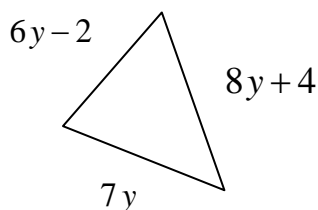
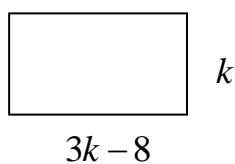
o. $\frac{x}{5} = \frac{1}{6}(x - 3)$

2. Given the perimeter of each shape, determine the unknown.

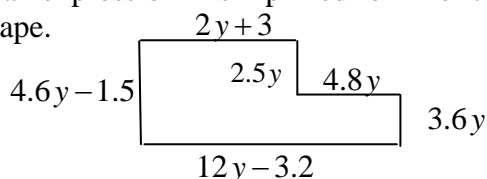
a. *perimeter* = 64

b. *perimeter* = 86

c. *perimeter* = 95.5



3. a. Write an expression in simplified form for the perimeter of the shape.



b. Determine the perimeter if $y = 2$.

Algebra

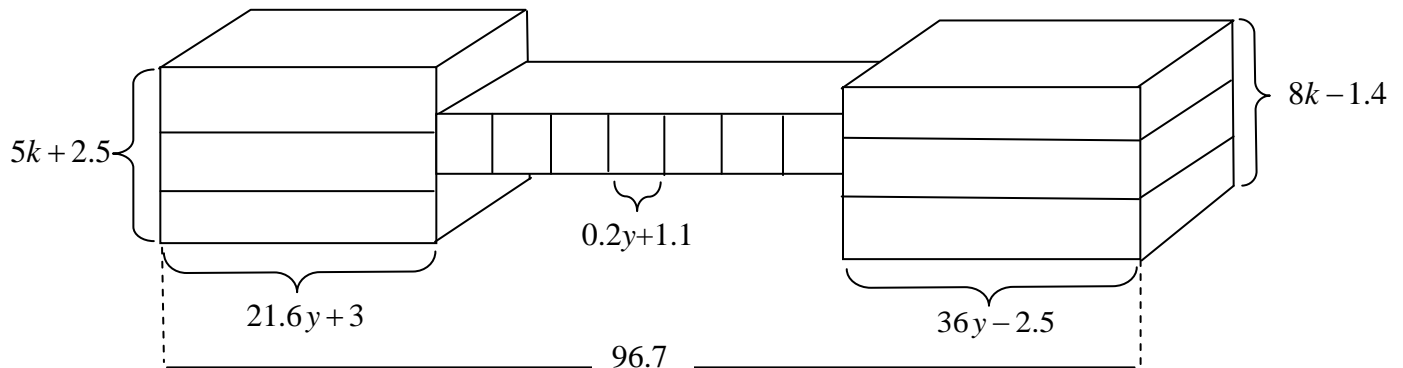
Did You Know?

The word Algebra comes from the title of a book in the Arabic language.

A Slice of History

The "=" symbol that is now universally accepted in mathematics for equality was first used by Welsh mathematician Robert Recorde in *The Whetstone of Witte* (1557).

4. A bridge connects two buildings with dimensions as shown.



- a. Given that the heights of the two buildings are the same, determine the value of k .
 b. Determine the value of y .
5. The rental costs in dollars, C , of two different conference rooms are based on the amount of time used in hours, h , plus a basic service charge. The costs are represented by the following two equations:
 Place A: $C = 50 + 2.5h$
 Place B: $C = 85 + 1.8h$

- a. If you want to rent a room from 8:00 a.m. today to 11:00 a.m. tomorrow, which hotel should you choose to minimize the cost? How much is the cost?
 b. If you want to rent a room for more than 3 days, which place should you choose to minimize the cost?
 c. Calculate the number of hours for which the costs of the two conference rooms are the same. How much is the cost?

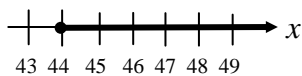


6. Graph each inequation using a number line.
- $x > 3$
 - $x \leq 3$
 - $2 < m \leq 5$
 - $x > -8$
 - $x < -1$
 - $-5 > y > -10$

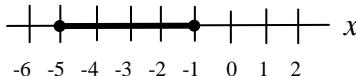
Symbol	Meaning
$<$	Less than
$>$	Greater than
\leq	Less than or equal to
\geq	Greater than or equal to

7. Write the inequality for each case.

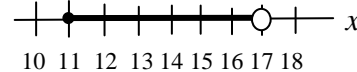
a.



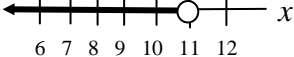
b.



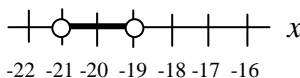
c.



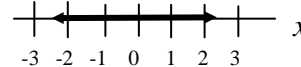
d.



e.



f.



8. Solve the following inequalities. Graph the result.

a. $x - 3 < 9$

b. $4x + 16 > 8$

c. $6(m + 2) \leq 2m + 8$

d. $\frac{m + 5}{3} \geq 9$

e. $\frac{x - 3}{3} + \frac{1}{4} > \frac{x + 1}{2}$

f. $4\left(x - \frac{1}{2}\right) - 2\left(\frac{3}{2} + x\right) \leq 10$

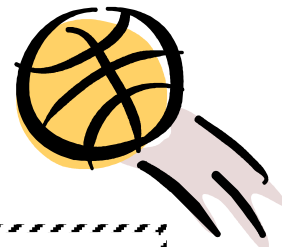
9. $\sqrt{a} \leq a$. True or false? Provide a counterexample if false.

10. A company has a budget of \$100,000 to spend on a project. A cost accountant predicts the labour cost will be \$50,545 and the cost of production for each unit of product will be \$2.50.

- What is the maximum number of products that the company can produce to remain within budget?
- If the selling price is \$6.00 per unit, how much profit can the company expect from the project if each unit is sold?
- What is the selling price per unit so that the company will have no profit or loss?

11. The velocity, V in metres per second, of a basketball thrown directly upward is modelled by the equation $V = 12 - 5t$ where t is measured in seconds.

- When will the basketball reach its maximum height?
- When will the velocity be between 1 and 3 metres per second?

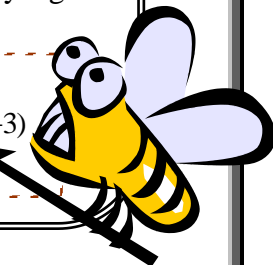


Solving an inequality requires similar techniques as solving an equation. The ONLY difference is that if you multiply or divide both sides of an inequality by a negative number, you reverse the direction of the inequality sign.

E.g.

$$\begin{aligned} -3y &> 9 \\ -3y \div (-3) &< 9 \div (-3) \end{aligned}$$

Therefore, $y < -3$



Don't forget to try these math drills now! Go to www.wiredmath.ca for the link.

TRY THESE!

Solving an Equation

<http://www.aaamath.com/equ725-equation1.html>

Solving an Inequality

<http://www.aaamath.com/g725-inequalities.html>

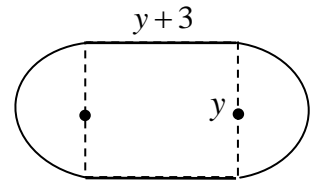


CHALLENGE YOURSELF!

12. Brett has \$5.00 and Jean has \$3.50. Brett spends three times as much as Jean. Now Brett has one-quarter as much money left as Jean has left. How much money did each person spend?

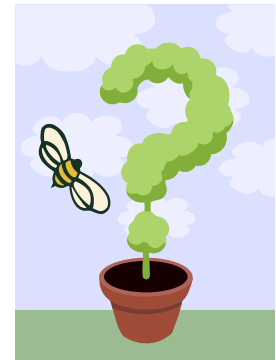
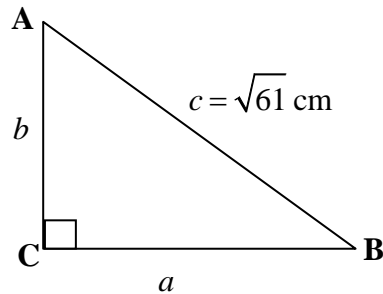
13. Refer to the diagram on the right. Answer the following questions.

- a. Determine the value of y given that the perimeter is 38.6 m. (Use $\pi = \frac{22}{7}$)
 Round your answer correct to two decimal places.
- b. Calculate the total area.



EXTENSION

14. Given that $a + b = 11$ cm and $\angle C = 90^\circ$, find the area of $\triangle ABC$.



15. Refer to the following diagram. Suppose Eric is pulling a rope in the rate of 1 m/s. How fast is the boat moving toward the cliff?

- a. less than 1 m/s b. exactly 1 m/s c. greater than 1 m/s
- Please justify your answer.

