

GRADE 9 LESSON 1  
Exponents and Exponent Laws

1. Write in exponential form:

a)  $7 \times 7 \times 7 \times 7 \times 7 \times 7$ ;

b)  $m \times m \times m \times m \times m$ ;

c)  $5 \times 5 \times 7 \times 7 \times 7$ ;

d)  $\frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times \frac{2}{5} \times 2.5 \times 2.5$  .

2. Evaluate:

a)  $10^4 \times 0.02 + \left(\frac{1}{2}\right)^{-1}$  ;

b)  $(3.1 + 0.08)^0 \div 2^{-1}$  ;

c)  $6^{-2} \times 36 \times \left(\frac{1}{6}\right)^{-1}$  .

3. Simplify:

a)  $a^5 \times a^{16} \times a^{-11}$  ;

b)  $\left(\frac{1}{3}m^6\right)^3 \cdot 9m^{10}$  ;

c)  $(x^4)^{12} \div x^8$  .

4. Raise to the exponent:

a)  $(2xy^2)^3$  ;

b)  $\left(-\frac{m^3}{2n}\right)^4$  ;

c)  $\left(\frac{2}{5}\right)^{-2} \cdot 2^{12} \cdot 2^{-10}$  .

5. Evaluate:

a)  $0.5^7 \times 2^7$  ;

b)  $\left(\frac{4}{3}\right)^{16} \times \left(\frac{3}{4}\right)^{16}$  ;

c)  $\frac{2^8 \cdot 2^6}{2^{20}}$  .

6. Record as a scientific notation ( $n \times 10^a$ ): 245 .

Answers: 1 a)  $7^6$  b)  $m^5$  c)  $5^2 \times 7^3$  d)  $(\frac{2}{5})^4 \times 2.5^2$

2 a) 202 b) 2 c) 6

3 a)  $a^{10}$  b)  $\frac{1}{3}m^{28}$  c)  $x^{40}$

4 a)  $8x^3y^6$  b)  $\frac{m^{12}}{16n^4}$  c) 25

5 a) 1 b) 1 c)  $2^{-6} = \frac{1}{64}$

6  $2.45 \times 10^2$

GRADE 9 LESSON 2  
Polynomials. Simplifying Algebraic Expressions

1. Write each monomial in the simplest form:

- a)  $3a^5a$ ;                      c)  $-ab5a$ ;  
b)  $(-b)(-b)^5$ ;                d)  $(2a)^3 \times 5ab$ .

2. Determine the area of a square with side length  $3a$ .

3. Determine the volume of a rectangular prism with the following dimensions:  
 $l = 2m$ ,  $w = 3n$ ,  $h = \frac{1}{6}mn$ . Use the formula  $V = lwh$ . Leave your answer as a simplified algebraic expression.

4. Create a polynomial with the following monomials:  $2x^2$ ,  $7x$ ,  $-8$

5. Subtract the following monomials in order:

- a)  $8xyz$  and  $-4xyz$ ;                      b)  $4x^2y$  and  $10x^2y$ .

6. Write in the simplest form:

- a)  $3x^2 + y^2 + 7x - 3x^2 - 4y^2 + 3y^2 - 10x$ ;  
b)  $ab^2 - 4a^2b + 7ab - (5ab^2 + 2a^2b)$ ;  
c)  $5 - 3x^2y + 3x - 2x \cdot 4xy$ .

7. Simplify:

- a)  $(4.2x^2 + 2x - 4) - (3.2x^2 + 2x - 5)$ ;  
b)  $(0.8x^3 - 0.1x^2 + 3x) - (-0.2x^3 + 0.1x^2 - 7x)$ .

Answers: 1 a)  $3a^6$  b)  $b^6$  c)  $-5a^2b$  d)  $40a^4b$

2  $9a^2$

3  $m^2n^2$

4  $2x^2 - 7x + 8$

5 a)  $12xyz$  b)  $-6x^2y$

6 a)  $-3x$  b)  $-4ab^2 - 6a^2b + 7ab$  c)  $-11x^2y + 3x + 5$

7 a)  $x^2 + 1$  b)  $x^3 - 0.2x^2 + 10x$

GRADE 9 LESSON 3  
Distributive Property. Common Factoring

1. Multiply a monomial by a polynomial:

- a)  $3 \cdot (a + b - c)$ ;
- b)  $(-5) \cdot (2a - 3b + c)$ ;
- c)  $2x \cdot (-5x + 3y - 6z)$ ;
- d)  $4b^2 \cdot (3a^2b - 2ab^2 + a^2)$  .

2. Fill in the blanks to make the equality true:

- a)  $(2a - \dots) \times 4a = \dots - 20a$  ;
- b)  $(8xy - 3x - \dots) \times 5x = \dots - \dots - 5x$  .

3. Simplify:

- a)  $3(x - 1) + 3(xy - x + 5)$ ;
- b)  $10ab - 5(a^2b^2 + 2ab)$ ;
- c)  $x(x^2 - 3) - x^3 + 4x + 5$ ;
- d)  $b(12c - 8b) - 2b(3c^2 - 4b)$  .

4. Simplify and determine the value of the algebraic expression:

- a)  $3a - 4b(2a - b) + 8ab$  where  $a = -2$ ,  $b = 3$
- b)  $6(4x^2 + 2x - 1) + 2x(-12x + 3)$  where  $x = -10$

5. Common factor the following:

- a)  $ab + 2bc$  ;
- b)  $10x - 10$  ;
- c)  $a^2 + 2ab - 3a$  ;
- d)  $9a^4 - 3a^2b$  .

6. Challenge! Common factor the following:  $4(x + y) - 10(x + y)$  .

Answers: 1 a)  $3a + 3b - 3c$  b)  $-10a + 15b - 5c$  c)  $-10x^2 + 6xy - 12xz$  d)  $12a^2b^3 - 8ab^4 + 4a^2b^2$

2 a)  $8a^2$  b) 1,  $40x^2y$ ,  $15x^2$

3 a)  $3xy + 12$  b)  $-5a^2b^2$  c)  $x + 5$  d)  $12bc - 6bc^2$

4 a)  $3a + 4b^2$ , 30 b)  $18x - 6$ ,  $-186$

5 a)  $b(a + 2c)$  b)  $10(x - 1)$  c)  $a(a + 2b - 3)$  d)  $3a^2(3a^2 - b)$

6  $-6(x + y)$

GRADE 9 LESSON 4  
SOLVING LINEAR EQUATIONS

1. Solve the following equations:

a)  $28 + 3x = 7x$  ;

b)  $3y + 18 = 3(y + 6)$  ;

c)  $5y + 18 = 4(y + 1) + y$  ;

d)  $16x + 10 - 21x = 35 - 5(2x + 1)$  .

2. Determine whether the given values are the solutions to the given equations:

a)  $x = -1$  ;  $5x - (2x + 7) = -10$  ;

b)  $x = 2$  ;  $7(x + 3) - 2x = 10$  .

3. Solve the following equations:

a)  $3y - 14(1 - 2y) = 17y$  ;

b)  $9 - 8(y - 11) = -2(y - 12.5)$  ;

c)  $3x - x^2 = 7 + x(4 - x)$  ;

d)  $3 - x - (3x - x^2) = x(x - 2)$  .

4. Solve the following equations:

a)  $\frac{10 - x}{5} = \frac{x + 3}{8}$  ;

b)  $\frac{2x - 7}{3} = \frac{-5 + x}{2}$  ;

c)  $\frac{2(8x - 1)}{3} = \frac{7 + 4x}{2}$  .

Answers: 1 a)  $x = 7$  b) Infinite number of solutions c) No solutions d)  $x = 4$

2 a) Yes b) No

3 a)  $y = 1$  b)  $y = 12$  c)  $x = -7$  d)  $x = 1.5$

4 a)  $x = 5$  b)  $x = -1$  c)  $x = 1.25$

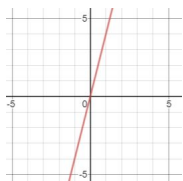


## GRADE 9 LESSON 5

### Linear Relations

1. Let the side length of a square be  $a$  cm. Determine the formula for the perimeter ( $P$ ) of a square. Create a graph showing how the size of the perimeter depends on the length of the side, when the side length varies from 0.5 to 4 cm. Use the graph to determine the length when the perimeter  $P = 12$  cm.
2. A biker left home and was traveling at a constant speed of 80 km/hr for 30 minutes. For the following hour he was moving at a speed of 60 km/hr. And then took a break at a cafe for half an hour. Following the break he traveled for another hour at a constant speed of 40 km/hr before he reached his final destination. There he stayed for 2 hours and then traveled back home at a constant speed without any breaks.
  - a) Graph the relationship of distance vs time.
  - b) What was the total distance traveled?
  - c) How far from the starting point was the biker after 1 hour?
  - d) How long did it take the biker to go there and back?
  - e) How far from the starting point was the biker after 5.5 hours?
  - f) How fast was the biker moving on the way back?
  - g) What was the average speed of the whole trip there and back?
3. The original temperature in a kettle was  $8^{\circ}\text{C}$ . After the kettle was turned on, every minute the water was  $2^{\circ}\text{C}$  warmer. Write an equation showing the change in temperature over time  $t$ . When will the water reach the boiling point ( $100^{\circ}$ )?

Answers: 1  $P = 4a$



when  $P=12$  cm,  $a = 3$ cm

2 a) Graph b) 140 km c) 70 km d) 7 hrs e) 105 km f) 70 km/hr g) 40 km/hr

3  $2t + 8$ ; 46 minutes

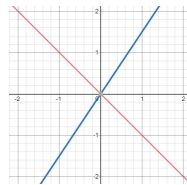
## GRADE 9 LESSON 6

### Linear Function. Slope of a Line

1. One side of a rectangle is 5 cm. Let the other side be  $x$ . Write the formula representing the area ( $A$ ) of this rectangle, then determine  $A$  when  $x = 5$  ?
2. Graph the functions  $y = -x$  and  $y = 1.5x$  on the same grid.
3. Create a table of values for the linear function defined by the equation  $y = \frac{x}{2} + 4$  for  $2 \leq x \leq 4$ . Then graph this function.
4. The equation of a linear function is  $y = 3x + 2$ 
  - a) Find  $y$ , if  $x = -1$ ,  $x = 0$ ,  $x = 3$
  - b) Find  $x$ , if  $y = 1$ ,  $y = 0$ ,  $y = 4$
5. Determine the  $x$ -*intercept* and the  $y$ -*intercept* of the function  $y = 3x + 6$ , then graph this function.
6. The graph of a linear function passes through the points  $A(0, -4)$  and  $B(2, 2)$ . Determine the slope of the line.

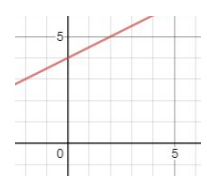
Answers: 1  $A = 5x$ ,  $A = 25 \text{ cm}^2$

2



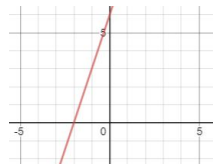
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$x_1$	$y_1$
2	5
4	6



4 a) -1, 2, 11 b)  $-\frac{1}{3}$ ,  $-\frac{2}{3}$ ,  $\frac{2}{3}$

5



$(-2, 0)$ ,  $(0, 6)$

6  $m = 3$

## GRADE 9 LESSON 7

### Surface Area and Volume. Pyramid and Cone

1. The total Surface Area of a square based pyramid with a height of 10 cm is  $SA = 300 \text{ cm}^2$ . Determine the total lateral area (all triangular faces).
2. A square based pyramid with the base side = 6 cm, has a volume of  $V = 60 \text{ cm}^3$ . Determine the height of the pyramid.
3. Volume of a cone is  $V = 32\pi \text{ cm}^3$ . The radius of the base of the cone is  $r = 4 \text{ cm}$ . Determine the height of the cone.
4. Challenge! A piece of wood is in the shape of a rectangular prism. Its base is 10 x 12 cm and its height is 20 cm. A hole in the shape of a cylinder with a diameter of 6 cm was cut through the wooden rectangular prism. Determine the volume of a rectangular prism with a hole.

Formula for finding the volume of a square based pyramid is  $V = \frac{l^2 h}{3}$

Formula for finding the SA of a square based pyramid is  $SA = l^2 + 4(\frac{ls}{2})$

Formula for finding the volume of a cone is  $V = \frac{\pi r^2 h}{3}$

Formula for finding the SA of a cone is  $SA = \pi r^2 + \pi rs$

Formula for finding the volume of a rectangular prism is  $V = lwh$

Formula for finding the volume of a cylinder is  $V = \pi r^2 h$

Formula for finding the SA of a rectangular prism is

$$SA = 2lw + 2wh + 2lh$$

Formula for finding the SA of a cylinder is  $SA = 2\pi r^2 + 2\pi rh$

Answers:  $1\ 200\text{ cm}^2$

$2\ 5\text{ cm}$

$3\ 6\text{ cm}$

$4(2400 - 720\pi)\text{ cm}^3$  (for an approximate solution use a calculator and round to the nearest tenths)