



# **Academic Upgrading**

**Academic Services**

## **Study Guide for Math Placement Test**

Updated: June 2016

# Important Information

## The Math Placement Test

The Math Placement test is a free assessment designed for Academic Upgrading placement purposes only. No section of the test may be used for admission to any SAIT program other than Academic Upgrading. The Math Placement Test is not accepted for admission to any other institution.

- Students write the test on campus at Testing Services (room MC 221, Stan Grad Centre). Testing Services hours of operation are available on [www.sait.ca/testing](http://www.sait.ca/testing).
- Students must book the test at least 24 hours in advance using instructions provided by Academic Upgrading. To receive instructions for booking the test or to arrange invigilation of the test outside Calgary, contact Academic Upgrading ([upgrading@sait.ca](mailto:upgrading@sait.ca) or 403-210-5756).
- Students will be contacted with test results 1-2 business days after the test.
- If you are not sure whether the Math Placement Test is the correct test for you to take, contact Academic Upgrading ([upgrading@sait.ca](mailto:upgrading@sait.ca) or 403-210-5756).

## Math Placement Study Guide

This study guide is designed to prepare students for the Academic Upgrading Math Placement test. Use the following practice exercises to prepare; you should aim for 70% in each section. An answer key is included at the end of this guide. This guide contains:

Sections	Study Exercises	Formula Sheet	Answer Key
<a href="#">Math Pre-100</a>	<a href="#">Pg. 4-7</a>	Not Applicable	<a href="#">Pg. 23</a>
<a href="#">Math Grade 9</a>	<a href="#">Pg. 8-13</a>	<a href="#">Pg. 34</a>	<a href="#">Pg. 24-26</a>
<a href="#">Math Grade 10</a>	<a href="#">Pg. 14-16 no calculator</a> <a href="#">Pg. 16-17 calculator</a>	<a href="#">Pg. 35</a>	<a href="#">Pg. 26-27</a>
<a href="#">Math Grade 11</a>	<a href="#">Pg. 18-21 no calculator</a> <a href="#">Pg. 22 calculator</a>	<a href="#">Pg. 35</a>	<a href="#">Pg. 28-33</a>

The Math Placement test is composed of four multiple choice sections. You must start with the first section (Math Pre-100) and work your way up through the rest of the sections. You may choose to schedule several sections per day, or to schedule them across multiple days.

#### Math Pre-100 test section

- This test (23 questions) is to be completed in 45 minutes.
- You are not allowed to use a calculator for the Pre-100 section. A mark of 70% on the Pre-100 section can be accepted in lieu of the math admission requirement to the daytime Academic Upgrading program and for entrance into MATH 100 (Math Foundations).

#### Math Grade 9 test section

- This test (26 questions) is to be attempted after completing the Pre-100 section.
- The Math Grade 9 section is to be completed in 75 minutes.
- You are not allowed to use a calculator for the Grade 9 section; however, you are provided with a formula sheet (identical to formula sheet in this guide). A mark of 70% on the Grade 9 section allows entrance into MATH 180 (Math 10C equivalent).

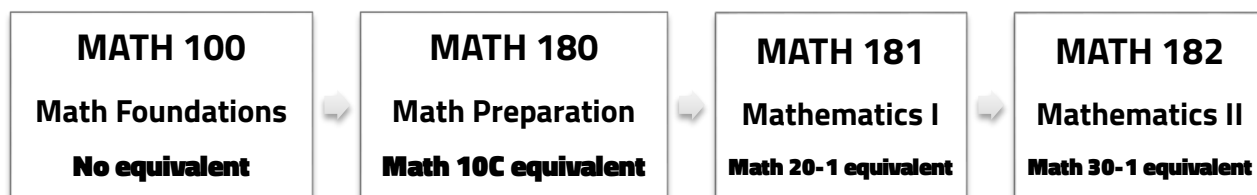
#### Math Grade 10 test section

- This test is to be attempted after completing the Pre-100 and Grade 9 sections.
- The Math Grade 10 section is composed of a non-calculator section and a calculator section. You will complete the non-calculator portion of the test first, submit your answers, and then receive the calculator portion (scientific calculator ONLY).
  - Non-calculator section (26 questions): 75 minutes
  - Calculator section (8 questions): 30 minutes
- A formula sheet is provided (identical to formula sheet in this guide). A mark of 70% on the Grade 10 section allows entrance into MATH 181 (Math 20-1 equivalent).

#### Math Grade 11 test section

- This test is to be attempted after completing the Pre-100, Grade 9, and Grade 10 sections.
- The Math Grade 11 section is composed of a non-calculator section and a calculator section. You will complete the non-calculator portion of the test first, hand in your answers, and then receive the calculator portion (scientific calculator ONLY).
  - Non-calculator section (30 questions): 75 minutes
  - Calculator section (3 questions): 30 minutes
- A formula sheet is provided (identical to formula sheet in this guide). A mark of 70% on the Grade 11 section allows entrance into MATH 182 (Math 30-1 equivalent).

## SAIT Academic Upgrading Course Sequence



Note: MATH 100 is not transferable outside of SAIT. MATH 180, MATH 181, and MATH 182 are accepted as admission requirements at other post-secondary institutions in Alberta, but you should always check with the post-secondary institution you are interested in attending (if it is not SAIT) to confirm it will accept the courses.

Note: SAIT also offers **MATH 172** (Applied Math 30 equivalent) and **MATH 162** (Mathematics 30-2 equivalent) as evening courses only, although they are not represented in the course sequence above. These two courses are acceptable for admission at SAIT and other colleges and polytechnics across Alberta, but not necessarily degree-granting institutions (refer to [www.acat.gov.ab.ca](http://www.acat.gov.ab.ca) for more information).

**Please review your future program's math admission requirements on [www.sait.ca](http://www.sait.ca) to determine which math stream is most-suitable for your needs.** For more details about these courses or the required testing scores to place into them, contact [upgrading@sait.ca](mailto:upgrading@sait.ca) or 403-210-5756.

## Pre-100 Math Exercises (to be completed without using a calculator)

1) In the number 74,127, which digit tells the number of hundreds, tens, thousands?

2) Write exponential notation:  $11 \cdot 11 \cdot 11 \cdot 11 \cdot 11$

### Adding whole numbers:

<b>3)</b>	4	<b>4)</b>	8	<b>5)</b>	2	<b>6)</b>	7	<b>7)</b>	12
	9		1		18		19		36
	15		12		17		8		14
	6		6		4		23		5
	2		11		3		11		7
	<u>+ 3</u>		<u>+ 9</u>		<u>+ 11</u>		<u>+ 6</u>		<u>+ 28</u>

### Subtracting whole numbers:

<b>8)</b>	564	<b>9)</b>	963	<b>10)</b>	378	<b>11)</b>	531	<b>12)</b>	6611
	<u>- 321</u>		<u>- 452</u>		<u>- 139</u>		<u>- 67</u>		<u>- 4332</u>

### Multiplying whole numbers:

<b>13)</b>	79	<b>14)</b>	83	<b>15)</b>	92
	<u>× 5</u>		<u>× 6</u>		<u>× 8</u>
<b>16)</b>	57	<b>17)</b>	389	<b>18)</b>	389
	<u>× 9</u>		<u>× 10</u>		<u>× 100</u>

### Dividing whole numbers with and without remainders:

<b>19)</b>	$715 \div 5$	<b>20)</b>	$782 \div 4$	<b>21)</b>	$847 \div 7$
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22)  $379 \div 9$

23)  $6 \overline{)2454}$

24)  $8 \overline{)4832}$

Solving for a variable:

25)  $18 + x = 41$  \_\_\_\_\_

26)  $39 + x = 87$  \_\_\_\_\_

27)  $42 = 42 + m$  \_\_\_\_\_

28)  $81 = 59 + a$  \_\_\_\_\_

Simplifying expressions with whole numbers:

29)  $5 + 10 - 3^2$  \_\_\_\_\_

30)  $6 \times 4 + 5^2 - 11$  \_\_\_\_\_

31)  $7 \times (2 + 3) - 21$  \_\_\_\_\_

32)  $(5 + 7) \div 2^2$  \_\_\_\_\_

Simplify fractions to simplest form:

33)  $\frac{3}{12}$

34)  $\frac{5}{25}$

35)  $\frac{4}{8}$

Multiplying fractions and simplify:

36)  $\frac{3}{4} \cdot \frac{7}{8}$

37)  $5 \cdot \frac{4}{7}$

38)  $\frac{8}{7} \cdot \frac{21}{16}$

39)  $\frac{1}{6} \cdot \frac{1}{8}$  \_\_\_\_\_

40)  $\frac{3}{4} \cdot \frac{5}{8}$  \_\_\_\_\_

41)  $\frac{7}{12} \cdot \frac{4}{5}$  \_\_\_\_\_

Adding and subtracting fractions. Simplify:

42)  $\frac{3}{5} + \frac{4}{5}$  \_\_\_\_\_ 43)  $\frac{4}{3} + \frac{1}{2}$  \_\_\_\_\_ 44)  $\frac{4}{9} + \frac{6}{27}$  \_\_\_\_\_

45)  $\frac{9}{10} + \frac{3}{7}$  \_\_\_\_\_ 46)  $\frac{1}{3} + \frac{3}{7}$  \_\_\_\_\_ 47)  $\frac{11}{25} + \frac{3}{4}$  \_\_\_\_\_

48)  $\frac{15}{8} - \frac{5}{8}$  \_\_\_\_\_ 49)  $\frac{9}{11} - \frac{1}{3}$  \_\_\_\_\_ 50)  $\frac{7}{5} - \frac{4}{3}$  \_\_\_\_\_

51)  $\frac{13}{16} - \frac{5}{8}$  \_\_\_\_\_ 52)  $\frac{26}{20} - \frac{2}{3}$  \_\_\_\_\_ 53)  $\frac{8}{15} - \frac{2}{10}$  \_\_\_\_\_

Adding decimals:

54) 
$$\begin{array}{r} 209.75 \\ + 17.36 \\ \hline \end{array}$$

55) 
$$\begin{array}{r} 681.542 \\ + 16.789 \\ \hline \end{array}$$

56) 
$$\begin{array}{r} 9.1073 \\ + 12.1561 \\ \hline \end{array}$$

57) 
$$\begin{array}{r} 42.009 \\ + 1.517 \\ \hline \end{array}$$

58) 
$$\begin{array}{r} 209.316 \\ + 7.052 \\ \hline \end{array}$$

59) 
$$\begin{array}{r} 7.1281 \\ + 0.5007 \\ \hline \end{array}$$

Adding and subtracting positive and negative values:

60)  $-5 - 9 =$  \_\_\_\_\_ 61)  $12 - (-2) =$  \_\_\_\_\_

62)  $5 - 6 =$  \_\_\_\_\_ 63)  $-4 - 6 =$  \_\_\_\_\_

64)  $-7 - (-10) =$  \_\_\_\_\_ 65)  $2 - 8 =$  \_\_\_\_\_

$$66) -9 - 1 = \underline{\hspace{2cm}} \qquad 67) -3 - (-4) = \underline{\hspace{2cm}}$$

$$68) 1 - (-14) = \underline{\hspace{2cm}}$$

Working with mixed fractions. Simplify:

$$69) 5 + 4\frac{5}{7} = \underline{\hspace{2cm}} \qquad 70). 1\frac{2}{5} \times 2\frac{1}{3} = \underline{\hspace{2cm}} \qquad 71) 2\frac{1}{4} + 6\frac{1}{4} = \underline{\hspace{2cm}}$$

Dividing positive and negative numbers:

$$72) 75 \div 5 = \underline{\hspace{2cm}} \qquad 73) -78 \div 3 = \underline{\hspace{2cm}}$$

$$74) 413 \div (-7) = \underline{\hspace{2cm}} \qquad 75) -300 \div (-12) = \underline{\hspace{2cm}}$$

$$76) -126 \div 21 = \underline{\hspace{2cm}} \qquad 77) -595 \div (-5) = \underline{\hspace{2cm}}$$

$$78) 270 \div (-15) = \underline{\hspace{2cm}} \qquad 79) -156 \div 26 = \underline{\hspace{2cm}}$$

Multiply:

$$80) 7(n - 4) = \underline{\hspace{2cm}} \qquad 81) 5(x + 6) = \underline{\hspace{2cm}}$$

$$82) -2(x - 7) = \underline{\hspace{2cm}}$$



## Grade 9 Mathematics Exercises (to be completed without using a calculator)

1) Find all the factors of the following:

a) 36

b) 30

c) 48

2) Solve the following and express your answer in both improper and mixed fraction formats:

a)  $4 + \frac{3}{5}$

b)  $1 + \frac{2}{5}$

c)  $2 + \frac{3}{4}$

3) Solve the following and express your answer in reduced form:

a)  $\frac{4}{5} - \frac{3}{8}$

b)  $\frac{3}{2} - \frac{2}{5}$

c)  $\frac{5}{3} - \frac{4}{5}$

4) Solve the following and put into reduced (simplest) form:

a)  $\frac{4}{7} \times \frac{3}{5}$

b)  $\frac{1}{3} \times \frac{3}{7}$

c)  $\frac{4}{5} \times \frac{5}{8}$

5) Solve the following and put into reduced (simplest) form:

a)  $\frac{3}{11} \div \frac{1}{3}$

b)  $\frac{2}{7} \div \frac{4}{3}$

c)  $\frac{3}{2} \div \frac{3}{4}$

6) Express as a decimal:

a)  $\frac{3}{8}$

b)  $\frac{3}{5}$

c)  $\frac{2}{9}$

7) What is

a) 30% of \$55?

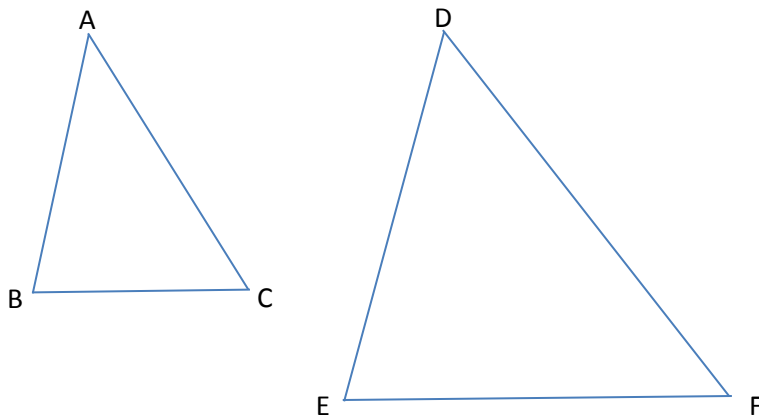
b) 25% of \$64?

c) 15% of \$22?

- 8) Alice buys a cake with a price tag of \$17. If the GST (federal sales tax) is 5%, what is the total price of the cake?
- 9) Jill buys a shirt with a price tag of \$32. If the GST (federal sales tax) is 8%, what is the total cost of Jillian's shirt?
- 10) Brad buys a pair of shoes with a price tag of \$85. If the GST (federal sales tax) is 3%, what is the total cost of his shoes?
- 11) Simplify the following expressions using exponential notation:
- a)  $A \times A \times A$                       b)  $b \times b \times b \times b$                       c)  $k \times k \times k \times k \times k \times k$
- 12) Place the following numbers in correct order from GREATEST to SMALLEST:
- a)  $-2/3, 3/4, 0.7, -0.545454, 2/5$                       b)  $3/5, -0.11111, 7/3, -2/3, 0.99$
- 13) Place the following numbers in correct order from SMALLEST to GREATEST:
- a)  $5/4, -0.2222, 1/2, -5/10, 0.585858$                       b)  $9/8, 0.141414, -2.0022, 1/6, -1/3$
- 14) Evaluate the following:
- a)  $30 - 3(12 + 6 \div 3) \times 5$                       b)  $8 + 2(20 - 4 \times 3) \div 2$                       c)  $7 + 2(15 - 3 \times 3) \div 4$
- 15) Solve the following equation for x:
- a)  $3x - 6 = 18$                       b)  $5x + 2 = 27$                       c)  $3x + 1 = 19$
- 16) A 5 metre-long ladder is leaned up against a wall. If the ladder reaches 3 m up the wall, how many metres is the base of the ladder from the wall?
- 17) A yard is 12 m long and 5 m wide. If you walked diagonally across the lawn (from one corner across the lawn to the other corner), how far did you walk?
- 18) A room is 6 m long and 8 m wide. If you walked diagonally across the room (from one corner across the room to the other corner), how far did you walk?

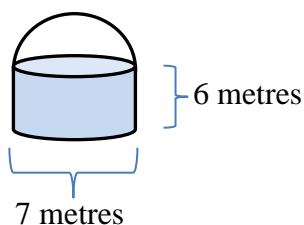
- 19) A large desk is 130 cm long and 60 cm wide. A piece of square note paper is 10 cm long and 10 cm wide. How many pieces of note paper (side-by-side) can fit on the desk?
- 20) A floor is 5 m long and 6 m wide. The floor is to be filled in with square tiles that are each 0.5 m long and 0.5 m wide. How many tiles will it take to cover the entire floor?
- 21) A large floor is 15 m long and 25 m wide. The floor is to be filled in with square tiles that are each 1.0 m long and 1.0 m wide. How many tiles will it take to cover the entire floor?
- 22) A soup can has a diameter of 5 cm and a height of 11 cm. Write an expression in terms of  $\pi$  that could be used to find the volume of the can.
- 23) A large cylindrical can of juice has a radius of 10 cm and a height of 18 cm. What is the volume of the can?
- 24) An oil drum has a radius of 50 cm and a height of 120 cm. What is the volume of the drum?

Use the following diagram of **similar** triangles to answer #25-27 below. Note that the diagrams below are not drawn to scale.



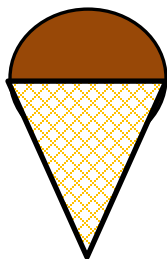
- 25) AC is 3 cm and DF is 10 cm. If DE is 8 cm, how long is AB? Answer to the nearest 10<sup>th</sup>cm.
- 26) AB is 4 mm, and DE is 8 mm. If EF is 7 mm, how long is BC? Express your answer as a reduced fraction.
- 27) BC is 3 m, and EF is 6 m. If DF is 8 m, how long is AC?

- 28) A 50 m tall building casts a shadow 20 m long. At the same time, a pole casts a shadow that is 4 m long. How tall is the pole?
- 29) A building casts a shadow of length 12 m. At the same time, a 2 m post casts a 6 m shadow. How tall is the building?
- 30) A building casts a shadow of length 20 m. At the same time, an 8 m tree casts a shadow 3 m long. How tall is the building?
- 31) A grain storage unit has the shape of a cylinder with a hemisphere on top as seen in the diagram below. The diameter of the base is 7 metres, and the height of the cylindrical part is 6 metres.



Write an expression in terms of  $\pi$  that could be used to find the volume of the grain storage unit.

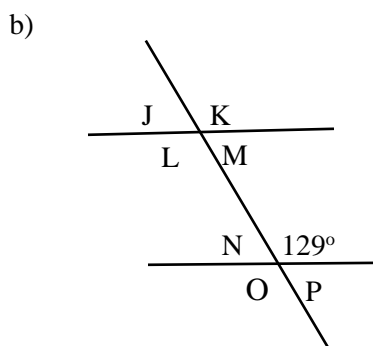
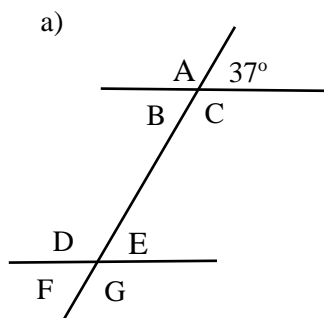
- 32) An ice cream cone is topped with one hemispherical scoop of chocolate ice cream as shown below. Note that the diagram is not drawn to scale.



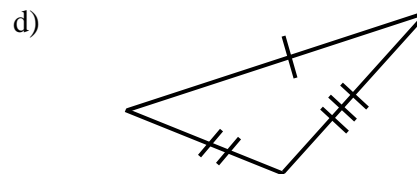
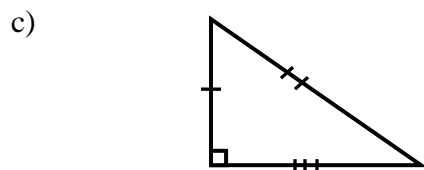
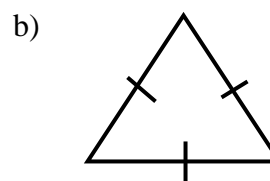
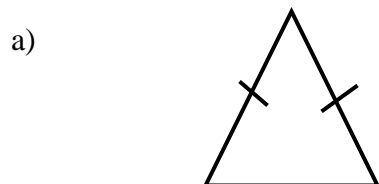
The diameter of the scoop of ice cream, which matches the diameter of the widest part of the cone, is 6 cm. The vertical height of the cone is 10 cm.

What expression can be used to calculate the volume of this entire object (cone + hemisphere of ice cream)?

**33)** State the value of each of the angles in the following diagrams:



**34)** Classify each type of the follow triangles:



**35)** Write each of the following in scientific notation:

a) 4 581

b) 31 523 872.2

c) 0.0000163

**36)** Convert each of the following from scientific notation to ordinary notation:

a)  $7.123 \times 10^6$

b)  $5.223 \times 10^{-3}$

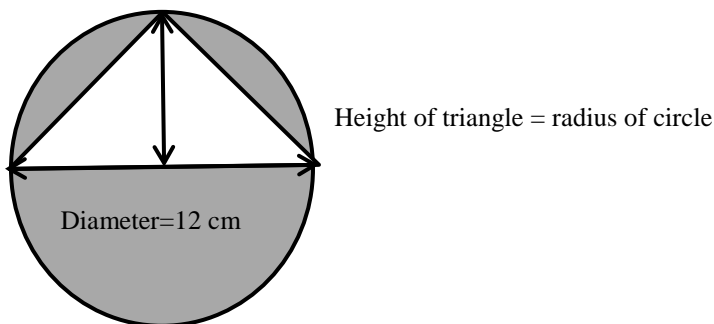
c)  $3.441 \times 10^{-5}$

**37)** Simplify:  $3(-7) - |-8(-2) - 5^2| + 9$

**38)** Divide 41.62 by 7.9. Answer in decimal form to the appropriate number of significant figures.

**39)** Clayton travelled 408 km in 5 hr. At this rate, how far would he travel in 12 hr? Answer to the nearest kilometre.

40) Determine the expression for the area of the shaded region. Use  $\pi$  where appropriate.



41) Simplify  $9(2a - 5) - 3(5a - 12)$

42) Simplify  $(5a - 2b^2)^2$

43) Simplify:  $(3p^5r^2)^3$

44) Solve  $6(x - 15) = 42$

45) Solve  $\frac{5}{2}x - \frac{1}{4} = \frac{7}{8}$

46) Evaluate the polynomial  $x^5 - 5x^4 + 3x^3 + 2x - 7$  when  $x = -1$ .

47) Evaluate the polynomial  $x^5 - 5x^4 + 3x^3 + 2x - 7$  when  $x = 2$ .

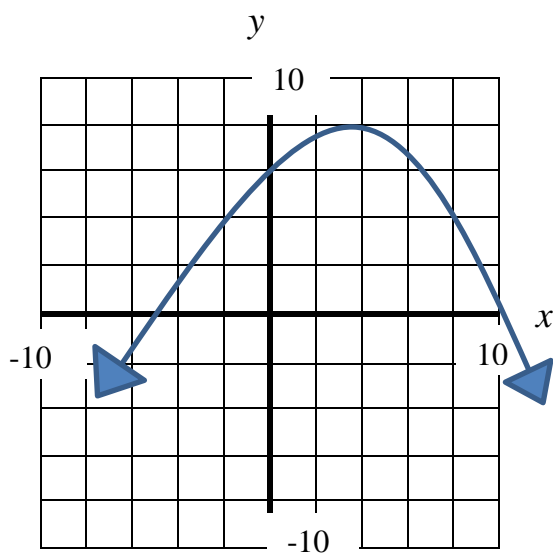
48) The length of a rectangle is 15 m longer than three times the width. The perimeter of the rectangle is 74 m. Find the dimensions. Answer in fractional form using mixed numbers.

49) In a pile of quarters (25 cent coins) and loonies (dollar coins), there are 15 more quarters than loonies. The total value of the coins is \$21.25. How many quarters are there?

**Grade 10 Mathematics Exercises (Non-calculator portion)**

- 1) Add the following numbers:  $2\frac{3}{5} + 1\frac{5}{6}$ .
- 2) Perform the following subtraction:  $\frac{7}{3} - \frac{13}{14}$ .
- 3) Multiply the following numbers:  $-\frac{9}{14} \times \frac{28}{27}$ . Express your answer in reduced form.
- 4) Perform the following division:  $-\frac{6}{15} \div \left(-\frac{16}{25}\right)$ . Express your answer in reduced form.
- 5) Which set of numbers represents the prime factorization of 192?
- 6) Determine the square root of 441.
- 7) Estimate the square root of 45 to the nearest tenth.
- 8) Simplify the following radical expression into a mixed radical by leaving the smallest possible integer under the radical:  $\sqrt{396}$
- 9) Convert the following mixed radical product into a single simplified radical expression:  
 $5\sqrt{3} \times 3\sqrt{6}$
- 10) Simplify the following exponent expression:  $(3a^2)(5a^3)$
- 11) Simplify the following exponent expression:  $-2y^{-3}(3y^3)^4$
- 12) Simplify the following exponent expression:  $(4x^3)3x^{-2}$
- 13) Simplify the following exponent expression:  $\left(\frac{3}{5}\right)^{-3}$
- 14) Perform the following multiplication:  $(3x - 4)^2$

- 15) Factor the following expression:  $x^3 - 1$
- 16) Factor the following expression:  $24x^6 + 18x^5 - 3x^4$
- 17) Factor the following expression:  $9x^2 - 16y^2$
- 18) Factor the following expression:  $x^2 - 9x - 36$
- 19) Factor the following expression:  $6x^2 - 19x + 15$
- 20) Determine the domain and range of the following graph.



- 21) Explain why the following set of ordered pairs could not be part of a function:  
 $(-3, 2), (2, -1), (-3, 5), (\frac{1}{2}, \frac{1}{4})$
- 22) Determine the slope of a line segment with end points  $(3, 1)$  and  $(6, -11)$ .
- 23) A line with slope  $\frac{1}{4}$  passes through  $(-2, -4)$ . Determine the y-value of a point where  $x = -1$ .



- 24) Determine if the following equations represent lines that are parallel to each other, perpendicular to each other, or neither.

$$2x - 3y = 1 \text{ and } 2y + 3x = 2$$

- 25) Given that  $f(x) = -2x^2 + 3x - 1$ , determine  $f(-1/3)$ .

- 26) Determine the ordered pair solution to following system of equations:

$$3x - 2y = 1 \text{ and } x + 2y = 2$$

### Grade 10 Mathematics Exercises (Scientific calculator portion)

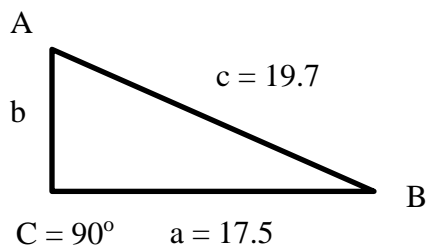
- 27) Determine  $\csc 17.3^\circ$  to 4 decimal places.

- 28) Determine angle A to the nearest tenth of a degree when  $\sin A = 0.4552$ .

- 29) Determine angle A to the nearest tenth of a degree when  $\sec A = 1.4965$ .

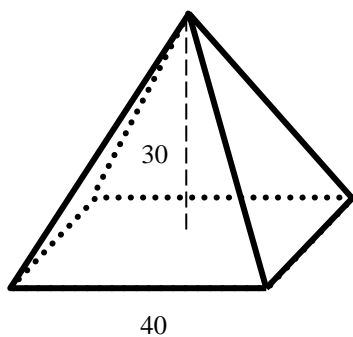
- 30) Convert 191 lb (pounds) to kg (kilograms) to 3 significant figures.  $1 \text{ kg} = 2.205 \text{ lb}$ .

- 31) Given a right triangle with  $C = 90.0^\circ$ ,  $c = 19.7$  and  $a = 17.5$ , determine the length of side b.

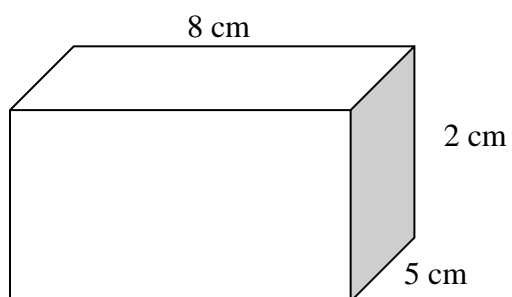


- 32) Using the right triangle from the previous question, determine angle A.

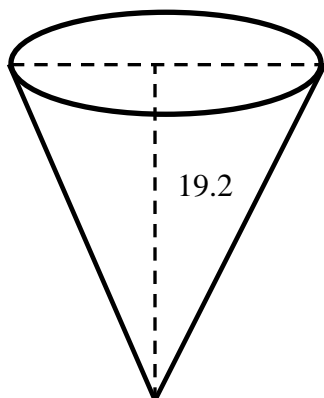
- 33) Determine the volume and lateral surface area of the following pyramid with a square base of 40.0 cm on each side and an overall height of 30.0 cm.



34) Determine the volume and total surface area of the following closed box:



35) Given that the volume and height of a right circular cone are, respectively,  $519 \text{ cm}^3$  and  $19.2 \text{ cm}$ , determine the diameter of the top.



## Grade 11 Mathematics Exercises (Non-calculator Portion)

1) Order the following numbers from largest to smallest.  $\left| -2\frac{1}{8} \right|$ ,  $-\left| -2\frac{1}{4} \right|$ ,  $-|2.5|$ ,  $\left| -2\frac{1}{4} \right|$

2) Express each of the following expressions to its simplest form:

a)  $\sqrt{\frac{2}{7}}$

b)  $\sqrt{9^2 + 5^2}$

c)  $\sqrt[3]{\frac{2a^4}{9}}$

d)  $3cd\sqrt{12a^3b^6c^7}$

3) Perform the following operations and simplify:

a)  $\frac{\sqrt{3}}{3\sqrt{6} + \sqrt{2}}$

b)  $(3\sqrt{2} - 4\sqrt{6})^2$

c)  $\sqrt[5]{32} \sqrt[3]{8}$

d)  $\frac{5 - \sqrt{10}}{\sqrt[4]{25}}$

4) Determine the real roots of each radical equation by solving the equation:

a)  $\sqrt{x-3} = 5$

b)  $\sqrt{2x+3} = x$

c)  $x = \sqrt{x+4} + 2$

d)  $\sqrt{5x-4} - \sqrt{x} = 2$

5) Start with the following equation  $\frac{x+1}{x-5}$  and determine equivalent simple fractions by:

- multiplying the numerator and the denominator by 3
- dividing the numerator and the denominator by 6
- multiplying the numerator and the denominator by  $x$

6) Simplify each of the following rational expressions:

a)  $\frac{a^2 + 4ab + 4b^2}{a + 2b}$

b)  $\frac{x^4 - 1}{x - 1}$

c)  $\frac{\frac{n^2 - 9}{n}}{\frac{1}{n} - \frac{1}{3}}$

d)  $\frac{2}{a+2} - \frac{3-a}{a^2+2a} + \frac{1}{a}$

e)  $\frac{4x^2 - 36}{x^3 - 25x} \times \frac{7x - 35}{3x^2 + 9x}$

f)  $\frac{a^3 - c^3}{2a^2 - 2c^2} \div \frac{a^2 + ac + c^2}{a^2 + 2ac + c^2}$

7) Solve each of the following expressions for  $x$ :

a)  $\frac{x}{2x-3} = 4$

b)  $\frac{3}{x+3} - \frac{1}{x} = \frac{5}{6+2x}$

c)  $\frac{2}{x^2-1} - \frac{2}{x+1} = \frac{1}{x-1}$

d)  $\frac{2}{2x^2+5x-3} + \frac{3}{2x+6} = \frac{1}{4x-2}$

- 8) Determine four angles that have the same reference angle as  $267^\circ$ .
- 9) What is the distance of a line segment starting at the origin and ending at the point (10, 4)?
- 10) Determine the exact value of:
- a)  $\sin 180^\circ$
  - b)  $\cos 90^\circ$
  - c)  $\tan 270^\circ$
- 11) Determine the exact value of  $\cos \theta$  and  $\tan \theta$  in simplest form, given that the terminal arm of the angle  $\theta$  goes through the point (6, 4).
- 12) Determine the exact value of  $\sin 30^\circ$ ,  $\tan 45^\circ$  and  $\cos 45^\circ$ .
- 13) Work with the given function:  $f(x) = x^2 - 3$
- a) Create a table of values for  $y = f(x)$ , including all intercepts.
  - b) Create a table of values for  $y = |f(x)|$ , including all intercepts.
  - c) Sketch the graphs of  $y = f(x)$  and  $y = |f(x)|$
  - d) Determine the domain and range of each of these functions.
- 14) Determine the domain and the range of the given function:  $f(x) = |x - 3| - 1$

**15)** Compare the function:  $y = 2(x-1)^2 + 5$  to the graph of  $y = x^2$

- a) Determine the axis of symmetry and the vertex.
- b) Determine the domain and range.
- c) What is the effect of  $-1$ ?
- d) What is the effect of  $+5$ ?
- e) What is the effect of  $2$ ?
- f) Sketch the graph of  $y = x^2$  and the graph of  $y = 2(x-1)^2 + 5$

**16)** Rearrange the quadratic equation  $y = 4x^2 + 2x + 1$  ( $y = ax^2 + bx + c$ ) to the form:

$y = a(x-p)^2 + q$  by completing the square.

**17)** Solve the following quadratic equation  $-2x^2 - x + 21 = 0$  by:

- a) factoring
- b) completing the square
- c) quadratic formula

**18)** Given the two equations:  $2x - 3y = 6$  and  $y = x^2 - 49$

- a) Sketch both equations on the same graph, including all intercepts.
- b) Solve the system of equations algebraically.

**19)** Solve the following inequalities.

- a)  $\frac{2}{3}(2-x) > \frac{1}{2} + x$
- b)  $2x < x - 6 < 3x + 10$
- c)  $x^2 - 16 < 6x$

## Grade 11 Mathematics Exercises (Scientific calculator portion)

20) The velocity  $v$  of an object falling under the influence of gravity is given in terms of its initial velocity  $v_0$ , the acceleration due to gravity,  $g$ , and the height,  $h$ , that an object is falling in the

equation:  $v = \sqrt{v_0^2 + 2gh}$ .

a) Solve for  $h$ .

b) What is the height of the object in metres for a velocity of 8.52 m/s with an initial velocity of 2.34 m/s, using the approximated acceleration due to gravity of 9.81 m/s<sup>2</sup>

21) Solve for all values of  $\theta$  to the nearest tenths, for  $0^\circ \leq \theta \leq 360^\circ$ , given  $\sin \theta = -0.4412$ .

22) Solve all possible triangles given:

a)  $a = 5.240$  m,  $b = 4.446$  m,  $B = 48.13^\circ$

b)  $a = 21.61$  cm,  $b = 29.33$  cm,  $c = 42.57$  cm

23) Two angles in a triangle measure  $42.0^\circ$  and  $59.5^\circ$  respectively. The longest side is 5.00 cm longer than the shortest side. What is the perimeter of the triangle?

24) In order to get around a concrete obstruction, an oil pipeline is constructed in two straight sections, one 3.756 km long and the other 4.675 km long, with an angle of  $168.85^\circ$  between the sections where they are joined. How much more pipeline was necessary due to the obstruction?

## Academic Upgrading Math Placement Answer Key

### Pre-Math 100 Answer Key

- 1) 1, 2, 4    2)  $11^5$
- 3) 39    4) 47    5) 55    6) 74    7) 102
- 8) 243    9) 511    10) 239    11) 464    12) 2279
- 13) 395    14) 498    15) 736    16) 513    17) 3890    18) 38 900
- 19) 143    20) 195 R2    21) 121    22) 42 R1    23) 409    24) 604
- 25) 23    26) 48    27) 0    28) 22
- 29) 6    30) 38    31) 14    32) 3
- 33)  $\frac{1}{4}$     34)  $\frac{1}{5}$     35)  $\frac{1}{2}$
- 36)  $\frac{21}{32}$     37)  $\frac{20}{7}$     38)  $\frac{3}{2}$     39)  $\frac{1}{48}$     40)  $\frac{15}{32}$     41)  $\frac{7}{15}$
- 42)  $\frac{7}{5}$     43)  $\frac{11}{6}$     44)  $\frac{2}{3}$     45)  $\frac{93}{70}$     46)  $\frac{16}{21}$     47)  $\frac{119}{100}$
- 48)  $\frac{5}{4}$     49)  $\frac{16}{33}$     50)  $\frac{1}{15}$     51)  $\frac{3}{16}$     52)  $\frac{19}{30}$     53)  $\frac{1}{3}$
- 54) 227.11    55) 698.331    56) 21.2634    57) 43.526    58) 216.368    59) 7.6288
- 60) -14    61) 14    62) -1    63) -10    64) 3    65) -6
- 66) -10    67) 1    68) 15
- 69)  $9\frac{5}{7}$     70)  $\frac{49}{15}$  or  $3\frac{4}{15}$     71)  $8\frac{1}{2}$
- 72) 15    73) -26    74) -59    75) 25    76) -6
- 77) 119    78) -18    79) -6
- 80)  $7n - 28$     81)  $5x + 30$     82)  $-2x + 14$



## Grade 9 Mathematics Answer Key

- 1) a) 1, 2, 3, 4, 6, 9, 12, 18, 36  
 b) 1, 2, 3, 5, 6, 10, 15, 30  
 c) 1, 2, 3, 4, 6, 8, 12, 16, 24, 48
- 2) a) improper:  $\frac{23}{5}$       b) improper:  $\frac{7}{5}$       c) improper:  $\frac{11}{4}$   
 mixed:  $4\frac{3}{5}$       mixed:  $1\frac{2}{5}$       mixed:  $2\frac{3}{4}$
- 3) a)  $\frac{17}{40}$       b)  $\frac{11}{10}$  or  $1\frac{1}{10}$       c)  $\frac{13}{15}$
- 4) a)  $\frac{12}{35}$       b)  $\frac{1}{7}$       c)  $\frac{1}{2}$
- 5) a)  $\frac{9}{11}$       b)  $\frac{3}{14}$       c) 2
- 6) a) 0.375      b) 0.6      c)  $0.\bar{2}$
- 7) a) \$16.50      b) \$16.00      c) \$3.30
- 8) \$17.85
- 9) \$34.56
- 10) \$87.55
- 11) a)  $A^3$       b)  $b^4$       c)  $k^6$
- 12) a)  $\frac{3}{4}, 0.7, \frac{2}{5}, -0.545454, -\frac{2}{3}$       b)  $\frac{7}{3}, 0.99, \frac{3}{5}, -0.111111, -\frac{2}{3}$
- 13) a)  $-\frac{5}{10}, -0.2222, \frac{1}{2}, 0.585858, \frac{5}{4}$       b)  $-2.0022, -\frac{1}{3}, 0.141414, \frac{1}{6}, \frac{9}{8}$
- 14) a) -180      b) 16      c) 10
- 15) a) 8      b) 5      c) 6
- 16) 4 m
- 17) 13 m
- 18) 10 m

19) 78 pieces

20) 120 tiles

21) 375 tiles

22)  $68.75\pi \text{ cm}^3$

23)  $1800\pi \text{ cm}^3$

24)  $300000\pi \text{ cm}^3$

25) 2.4 cm

26)  $\frac{7}{2} \text{ mm}$  or  $3\frac{1}{2} \text{ mm}$

27) 4 m

28) 10 m

29) 4 m

30) 53.3 m

31)  $\left(\frac{147}{2}\pi + \frac{343}{12}\pi\right) \text{ m}^3$

32)  $48\pi \text{ cm}^3$

33) a) A -  $143^\circ$

B -  $37^\circ$

C -  $143^\circ$

D -  $143^\circ$

E -  $37^\circ$

F -  $37^\circ$

G -  $143^\circ$

b) J -  $51^\circ$

K -  $129^\circ$

L -  $129^\circ$

M -  $51^\circ$

N -  $51^\circ$

O -  $129^\circ$

P -  $51^\circ$

34) a) isosceles

b) equilateral, equiangular

c) right-angle, scalene

d) scalene

35) a)  $4.581 \times 10^3$

b)  $3.15238722 \times 10^7$

c)  $1.63 \times 10^{-5}$

36) a) 7123000

b) 0.005223

c) 0.00003441

- 37) -21
- 38) 5.3
- 39) 979 km
- 40)  $(36\pi - 36)cm^2$
- 41)  $3a - 9$
- 42)  $25a^2 - 20ab^2 + 4b^4$
- 43)  $27p^{15}r^6$
- 44)  $x=22$
- 45)  $x = \frac{9}{20}$
- 46) -18
- 47) -27
- 48)  $width = 5\frac{1}{2}m; length = 31\frac{1}{2}m$
- 49) There are 29 quarters. (There are also 14 loonies.)

### Grade 10 Mathematics Answer Key

- 1)  $4\frac{13}{30}$                       2)  $\frac{59}{42}$                       3)  $-\frac{2}{3}$                       4)  $\frac{5}{8}$
- 5)  $2 \times 2 \times 2 \times 2 \times 2 \times 2 \times 3$
- 6) 21
- 7) 6.7
- 8)  $6\sqrt{11}$
- 9)  $45\sqrt{2}$
- 10)  $15a^5$
- 11)  $-162y^9$
- 12)  $12x$

- 13)  $\frac{125}{27}$
- 14)  $9x^2 - 24x + 16$
- 15)  $(x - 1)(x^2 + x + 1)$
- 16)  $3x^4(8x^2 + 6x - 1)$
- 17)  $(3x + 4y)(3x - 4y)$
- 18)  $(x - 12)(x + 3)$
- 19)  $(2x - 3)(3x - 5)$
- 20) Domain:  $x \in R$ ; Range:  $y \in R, y \leq 8$
- 21) The 2 points  $(-3, 2)$  and  $(-3, 5)$  have the same  $x$  value. In a function, a specific value of  $x$  can only map to a single value of  $y$ .
- 22)  $-\frac{4}{1}$  or  $-4$
- 23)  $y = -\frac{15}{4}$
- 24) The slopes are negative reciprocals indicating perpendicular lines.
- 25)  $-2\frac{2}{9}$  or  $-\frac{20}{9}$
- 26)  $\left(\frac{3}{4}, \frac{5}{8}\right)$
- 27) 3.3628
- 28)  $27.1^\circ$
- 29)  $48.1^\circ = A$
- 30) 86.6 kg
- 31)  $b = 9.05$
- 32)  $A = 62.7^\circ$
- 33)  $16000 \text{ cm}^3$
- 34)  $SA = 132 \text{ cm}^2$ ;  $V = 80 \text{ cm}^3$
- 35) 10.2 cm

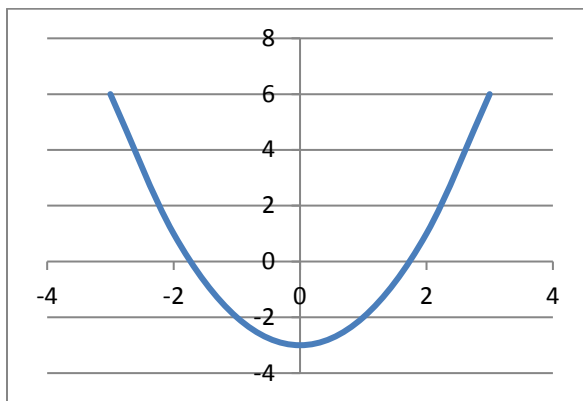
## Grade 11 Mathematics Answer Key

- 1)  $\left| -2\frac{1}{4} \right|, \left| -2\frac{1}{8} \right|, -\left| -2\frac{1}{4} \right|, -|2.5|$
- 2) a)  $\frac{\sqrt{14}}{7}$       b)  $\sqrt{106}$       c)  $\frac{a\sqrt[3]{6a}}{3}$       d)  $6ab^3c^4d\sqrt{3ac}$
- 3) a)  $\frac{9\sqrt{2}-\sqrt{6}}{52}$       b)  $114-48\sqrt{3}$       c) 4      d)  $\sqrt{5}-\sqrt{2}$
- 4) a)  $x = 28$       b)  $x = 3$  only;  $x = -1$  is an extraneous root and not a solution!  
 c)  $x = 5$  ( $x = 0$  is an extraneous root)      d)  $x = 4$  ( $x = 1$  is an extraneous root)
- 5) a)  $\frac{3x+3}{3x-15}$       b)  $\frac{6x+6}{6x-30}$       c)  $\frac{x^2+x}{x^2-5x}$
- 6) a)  $a+2b$       b)  $(x^2+1)(x+1)$       c)  $-n-3$   
 d)  $\frac{4a-1}{a(a+2)}$       e)  $\frac{28(x-3)}{3x^2(x+5)}$       f)  $\frac{a+c}{2}$
- 7) a)  $x = \frac{12}{7}$       b)  $x = -6$       c) no solution! ( $x = 1$  is an extraneous root)      d)  $x = \frac{2}{5}$
- 8)  $87^\circ, -87^\circ, 93^\circ, 273^\circ$  (many other possibilities exist).
- 9)  $2\sqrt{29}$
- 10) a)  $\sin 180^\circ = 0$       b)  $\cos 90^\circ = 0$       c)  $\tan 270^\circ$  is undefined
- 11) Radius length is  $r = 2\sqrt{13}$ , therefore  $\cos \theta = \frac{3\sqrt{13}}{13}$  and  $\tan \theta = \frac{2}{3}$
- 12)  $\sin 30^\circ = \frac{1}{2}$ ,  $\tan 45^\circ = 1$  and  $\cos 45^\circ = \frac{\sqrt{2}}{2}$

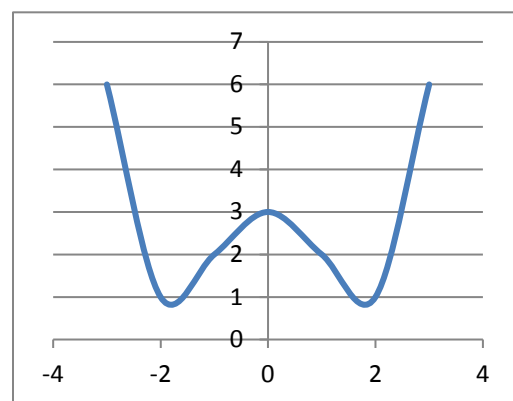
**13) a) & b)** Table of values, domain & range

x	$y = f(x) = x^2 - 3$	$y =  f(x)  =  x^2 - 3 $
-3	6	6
-2	1	1
-1	-2	2
0	-3	3
1	-2	2
2	1	1
3	6	6
$\sqrt{3}$	0	undefined
$-\sqrt{3}$	0	Undefined
Domain	Set of real numbers for x	Set of real numbers for x
Range	Set of real numbers for y; $y \geq -3$	Set of real numbers for y; $y \geq 4/5$ (approx.); difficult to specify here (look at graph)

Graph of  $y = f(x) = x^2 - 3$



Graph of  $y = |f(x)| = |x^2 - 3|$



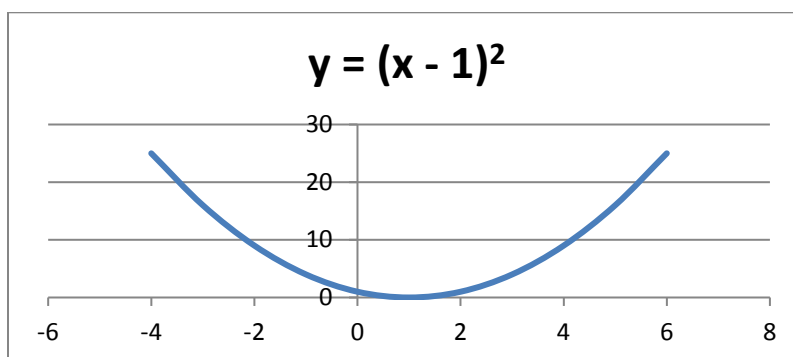
**14) Domain:** set of real numbers for x

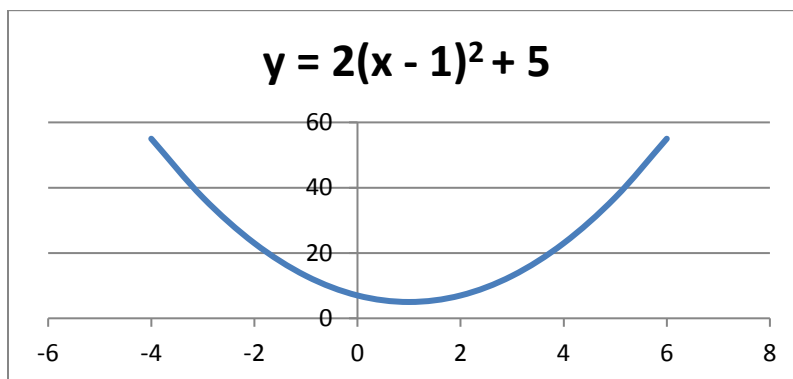
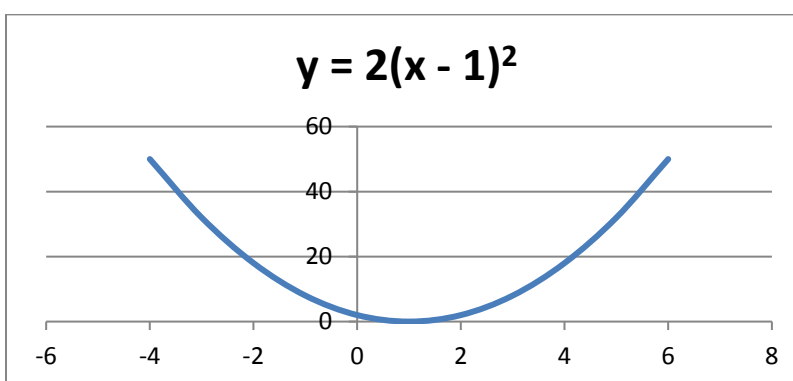
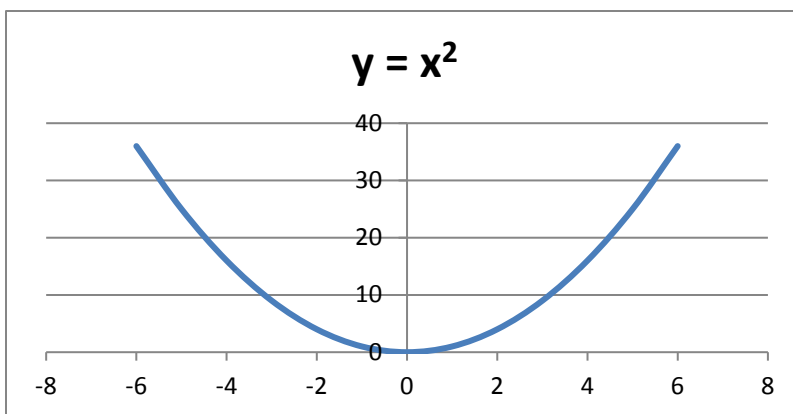
**Range:** set of real numbers for  $f(x)$ ;  $f(x) \geq -1$

15)

x	$y = x^2$	$y = (x - 1)^2$	$y = 2(x - 1)^2$	$y = 2(x - 1)^2 + 5$
-6	36	49	98	103
-5	25	36	72	77
-4	16	25	50	55
-3	9	16	32	37
-2	4	9	18	23
-1	1	4	8	13
0	0	1	2	7
1	1	0	0	5
2	4	1	2	7
3	9	4	8	13
4	16	9	18	23
5	25	16	32	37
6	36	25	50	55

- axis of symmetry is  $x = 1$ ; vertex is  $(1, 5)$
- domain is set of real values for  $x$ ; range is set of real numbers for  $y$ ,  $y \geq 5$
- The effect of  $-1$  is a translation of one unit right.
- The effect of  $+5$  is a translation of 5 units upward.
- The effect of 2 is a vertical stretch.
- Graphs of  $y = x^2$  and  $y = 2(x - 1)^2 + 5$  are shown below.





**16)**  $y = 4\left(x + \frac{1}{4}\right)^2 + \frac{3}{4}$

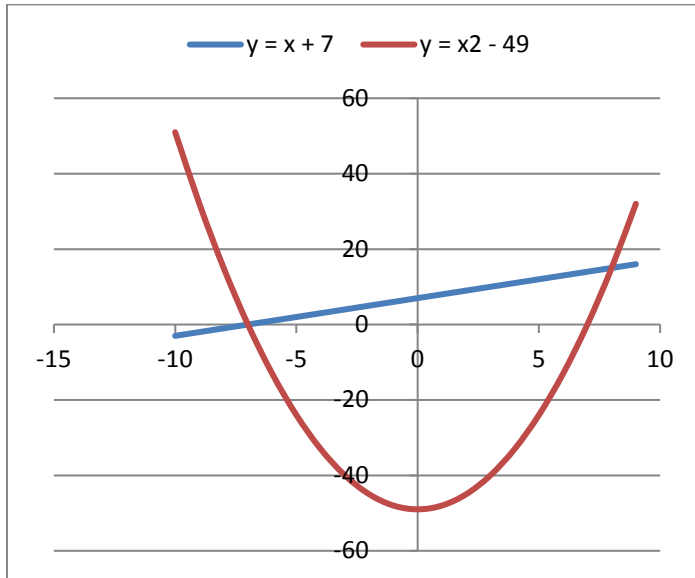
**17) a)**  $(2x - 7)(x + 3) = 0$ ;  $x = \frac{7}{2}$  or  $x = -3$

**b)**  $\left(x - \frac{1}{4}\right)^2 = \frac{169}{16}$ ;  $x = \frac{1}{4} \pm \frac{13}{4}$ ;  $x = \frac{7}{2}$  or  $x = -3$



$$c) \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} = \frac{-1 \pm \sqrt{1^2 - 4(-2)(21)}}{2(-2)} = \frac{-1 \pm \sqrt{169}}{-4} = \frac{-1 \pm 13}{-4}; \quad x = \frac{7}{2} \text{ or } x = -3$$

18) a)



x	$y = x + 7$	$y = x^2 - 49$
-10	-3	51
-9	-2	32
-8	-1	15
-7	0	0
-6	1	-13
-5	2	-24
-4	3	-33
-3	4	-40
-2	5	-45
-1	6	-48
0	7	-49
1	8	-48
2	9	-45
3	10	-40
4	11	-33
5	12	-24
6	13	-13
7	14	0
8	15	15
9	16	32

b) (8, 15) and (-7, 0)

19) a)  $x < \frac{1}{2}$

b)  $-8 < x < -6$

c)  $-2 < x < 8$

20) a)  $h = \frac{v^2 - v_0^2}{2g}$

b) The height of the object is 3.42 m. (note: 3 significant digits)

21)  $\theta = 206.2^\circ$  or  $\theta = 333.8^\circ$

**22)** a)  $c = 5.628$  m,  $A = 61.36^\circ$ ,  $C = 70.51^\circ$  or  $c = 1.366$  m,  $A = 118.64^\circ$ ,  $C = 13.23^\circ$

b)  $A = 28.0^\circ$ ,  $B = 39.5^\circ$ ,  $C = 112.5^\circ$

**23)** third angle is  $78.5^\circ$ , longest side = shortest side + 5; sides are 10.8 cm, 15.8 cm and 13.9 cm respectively, perimeter is 40.5 cm

**24)** long side is 8.392 km;  $3.756 + 4.675 - 8.3916 = 0.0394$ ; 0.0394 km more pipeline was needed

Note: There is no formula sheet for Pre-Math 100 section.

## Grade 9 Formula Sheet

Pythagorean Theorem	$c^2 = a^2 + b^2$
Triangle	$A = \frac{1}{2}bh$
Square	$A = s^2$
Rectangle	$A = lw$
Parallelogram	$A = bh$
Circle	$C = 2\pi r$ $A = \pi r^2$
Rectangular solid	$V = lwh$ $A = 2lw + 2lh + 2wh$
Right circular cylinder	$V = \pi r^2 h$ $A = 2\pi r^2 + 2\pi rh$
Right prism	$V = Bh$ (B = area of the base)
Right circular cone	$V = \frac{1}{3}\pi r^2 h$ $A = \pi r^2 + \pi rs$ (s = slant height)
Sphere	$V = \frac{4}{3}\pi r^3$ $A = 4\pi r^2$

## Grade 10 and 11 Formula Sheet

Volume of a right prism: $V = Bh$	
Volume of a right circular cone: $V = \frac{1}{3}\pi r^2 h$	
Volume of a right pyramid: $V = Bh/3$	
Volume of a right circular cylinder: $V = \pi r^2 h$	
B is the area of the base (or top) and h is the overall height of the figure.	
Surface area of a right prism: sum of the areas of all the faces (all rectangles where $A = lw$ )	
Surface area of a circular cone: $SA = 2\pi r^2 + 2\pi rs$ where s is the slant height.	
Surface area of a pyramid: $SA = B +$ sum of the side triangular faces where each face has a slant height.	
Surface area of a right circular cylinder: $SA = 2\pi r^2 + 2\pi rh$	
B is the area of the base (or top) and h is the overall height of the figure. Note that Lateral surface area does not include the B for all of these figures.	
Area of a circle: $A = \pi r^2$	Circumference of a circle: $c = 2\pi r$
Straight line: $Ax + By + C = 0$ (general form)	
Linear equation (slope-intercept form): $y = mx + b$	
Linear equation (point-slope form): $y_2 - y_1 = m(x_2 - x_1)$	
Definition of slope: $m = \frac{y_2 - y_1}{x_2 - x_1}$	Distance formula: $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Quadratic equation: $ax^2 + bx + c = 0$	Quadratic formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Law of sines: $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$	Law of cosines: $c^2 = a^2 + b^2 - 2ab \cos C$ $a^2 = b^2 + c^2 - 2bc \cos A$ $b^2 = a^2 + c^2 - 2ac \cos B$

