



Academic Upgrading

Academic Services

Study Guide for Placement into Grade 12 (Math 30-1/Math 182) Math

Updated: March 2020

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.

- The passing mark required for eligibility to register in Math 182 (Math 30-1) is 60%.
- We aim to put students' passing marks on our system within 2 business days of successful completion of the [test](#).
**Students must have a SAIT ID number in order for us to enter their marks.*
- Students, who have been accepted into the Academic Upgrading program, can register for the course they are placed into once we have granted them permission based on their passing grades.
- Students who have already taken and passed SAIT's Academic Upgrading courses in Math and Physics ARE NOT required to take a placement tests.

Math Placement Study Guide

This study guide is designed to prepare students for the Academic Upgrading Math Placement test for Math 30-1 (Math 182). Use the following grade 11 practice exercises to prepare for your online placement test to meet eligibility for Math 30-1. An answer key is included at the end of this guide.

This test is for placement into grade 12 Math 30-1 equivalency (Math 182):

- This test (15 questions) is to be attempted
- The test is to be completed in 45 minutes.
- A passing mark of 60% or greater is required in this test for eligibility to register for Math 182
- You only require a calculator for the a few questions in this test; the majority of the questions do not require a calculator. You are provided with a formula sheet (identical to formula sheet in this guide), which you should download and/or print and have on hand for the test.
- **Instructions for each test are also provided at the start of the test.**

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 for more information).

Please review your future program's math admission requirements on 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 or 403-210-5756.

Grade 11 Mathematics content – Practice Exercises (Non-calculator portion)

These will be similar to what you will be tested on in the placement test into Grade 12 (Math 30-1/Math 182) math.

(All are to be completed without using a calculator – unless otherwise indicated)

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:

a) multiplying the numerator and the denominator by 3

b) dividing the numerator and the denominator by 6

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

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

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

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

- 8) Determine four angles that have the same reference angle as 267° .
- 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 θ 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 $y = x + 7$ 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^2

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

22) Solve all possible triangles given:

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

b) $a = 21.61 \text{ cm}$, $b = 29.33 \text{ cm}$, $c = 42.57 \text{ cm}$

23) Two angles in a triangle measure 42.0° and 59.5° 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° between the sections where they are joined. How much more pipeline was necessary due to the obstruction?

Grade 11 Mathematics content – for placement into grade 12 (Math 30-1/Math 182)

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

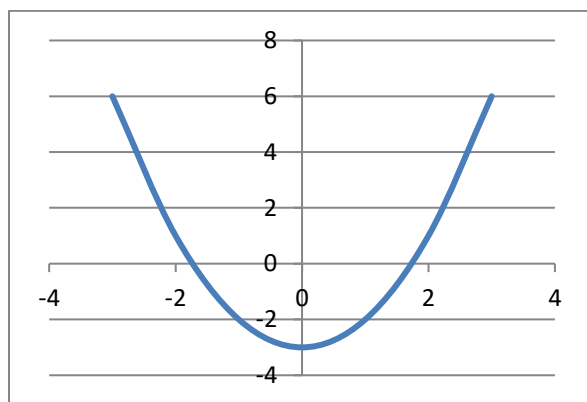
11) Radius length is $r = 2\sqrt{13}$, therefore $\cos \theta = \frac{3\sqrt{13}}{13}$ and $\tan \theta = \frac{2}{3}$

12) $\sin 30^\circ = \frac{1}{2}$, $\tan 45^\circ = 1$ and $\cos 45^\circ = \frac{\sqrt{2}}{2}$

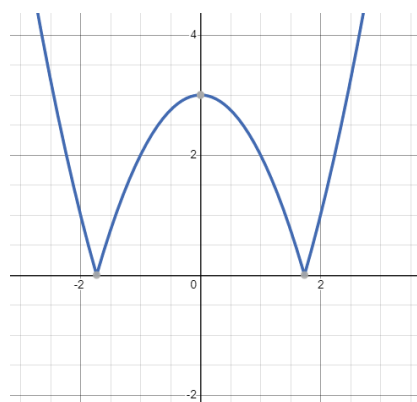
13) a) & b) Table of values, domain & range

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	$x \in R$	$x \in R$
Range	$y \geq -3$	$y \geq 0$

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



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



14) Domain: set of real numbers for x

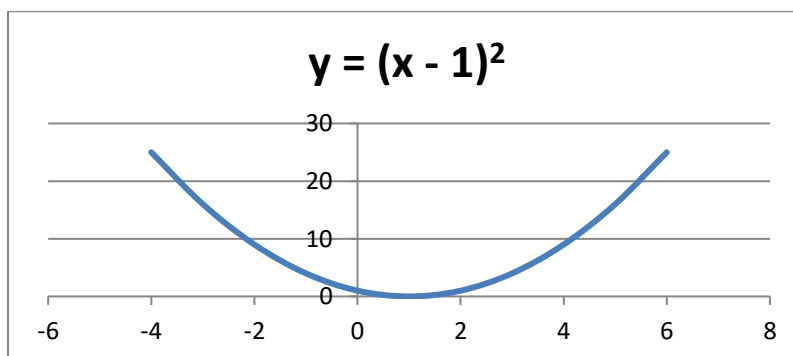
Range: set of real numbers for $f(x)$; $f(x) \geq -1$

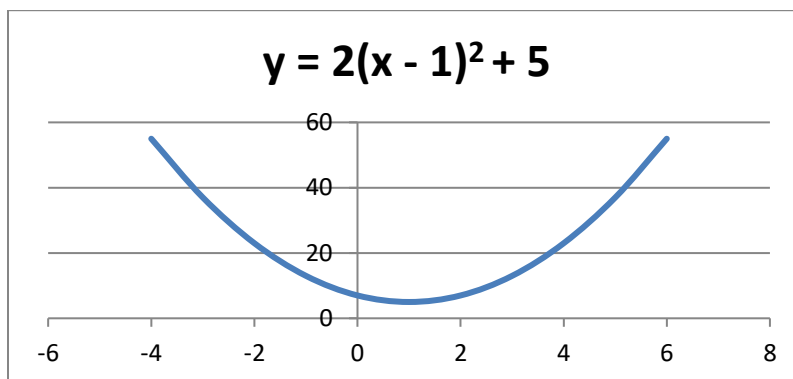
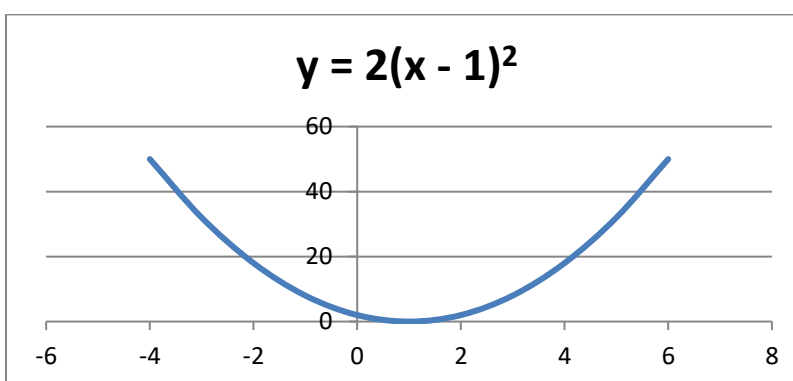
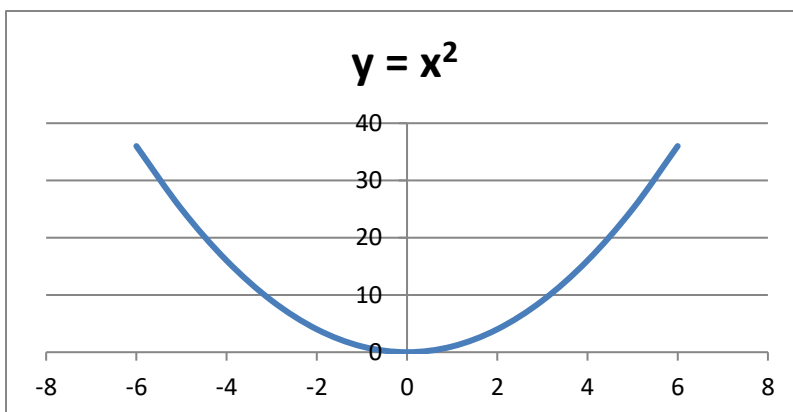
15)

x	$y = x^2$	$y = (x - 1)^2$	$y = 2(x - 1)^2$	$y = 2(x - 1)^2 + 5$
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-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.





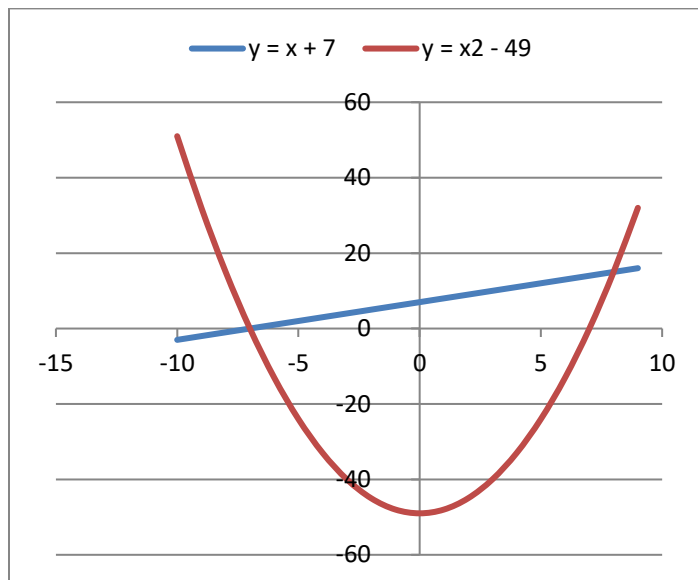
16) $y = 4\left(x + \frac{1}{4}\right)^2 + \frac{3}{4}$

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.)

$$x + 7 = x^2 - 49$$

$$x + 7 = x^2 - 49$$

$$0 = x^2 - x - 56$$

$$0 = (x - 8)(x + 7)$$

$$x = 8 \text{ or } x = -7$$

For $x = 8$: For $x = -7$:

$$y = x + 7 \quad y = x + 7$$

$$y = 8 + 7 \quad y = -7 + 7$$

$$y = 15 \quad y = 0$$

The points of intersection are (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° , 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

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: $c^2 = a^2 + b^2 - 2ab \cos C$ $a^2 = b^2 + c^2 - 2bc \cos A$ $b^2 = a^2 + c^2 - 2ac \cos B$

