Academic Upgrading

Academic Services

Study Guide for

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

Updated: June 2023

__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 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 (Math 20-1) practice exercises to prepare for your 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):

- The test is written in the Testing Centre.
- You will be provided with a **formula sheet** (identical to formula sheet in this guide).
- This test is **15 questions** (all multiple choice; no work shown).
- The time limit of the test is **60 minutes**.
- A passing mark of **60%** or greater is required in this test for eligibility to register for Math 182.

SAIT Academic Upgrading Course Sequence

MATH 100		MATH 180		MATH 181		MATH 182
Math Foundations		**Math Preparation**		**Mathematics I**		**Mathematics II**
No equivalent	→	**Math 10C equivalent**	→	**Math 20-1 equivalent**	→	**Math 30-1 equivalent**

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). Talk to an upgrading advisor for more information on the tests required for those courses as it is different than for Math 182.

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 (from Math 20-1) – Practice Exercises

These will be similar to what you will be tested on in the placement test into Grade 12 (Math 30-1/Math 182) math. Note that the Sequences & Series unit is NOT on this guide and is NOT on the placement test.

All questions below should be completed without a calculator.

1) Simplify each of the following expressions:

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

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

   c) $\sqrt[3]{\dfrac{16a^4}{27}}$

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

2) Perform the following operations and simplify:

   a) $\left(3\sqrt{2} - 4\sqrt{6}\right)^2$

   b) $\dfrac{4 - \sqrt{10}}{\sqrt{72}}$

   c) $\dfrac{\sqrt{3}}{3\sqrt{6} + \sqrt{2}}$

3) Solve the following radical equations (do not include extraneous answers):

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

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

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

4) Simplify each of the following rational expressions:

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

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

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

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

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

5) Solve each of the following rational equations (do not include any extraneous answers):

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

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

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

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

6) Determine the exact value of each of the following:
   a) cos 315°
   b) tan 135°
   c) sin 150°
   d) cos 120°
   e) sin 180°
   f) cos 90°
   g) cos 180°
   h) tan 270°

7) Determine the exact values of sin θ, cos θ, and tan θ in simplest form, given that the terminal arm of the angle θ goes through the point (-6, 4).

8) Solve for all angles of θ, $0° \le \theta \le 360°$, for each of the following:
   a) $\tan \theta = \sqrt{3}$

   b) $\cos \theta = \dfrac{-\sqrt{3}}{2}$

   c) $\sin \theta = \dfrac{-\sqrt{2}}{2}$

   d) $\sin \theta = -1$
   e) $\cos \theta = 0$
   f) $\tan \theta = $ undefined

9) For the function $f(x) = x^2 + x - 12$:
   a) Draw the function. Clearly show x-intercepts, the y-intercept, and the vertex, and state the domain and range of the function.

   b) Draw the graph of $y = |f(x)|$. Clearly show x-intercepts, the y-intercept, and the vertex, and state the domain and range of the function.

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

11) For the function $f(x) = \dfrac{1}{2}|x-2| - 4$:

   a.) Draw the graph of the function. Clearly show x-intercepts, the y-intercept, and the vertex, and state the domain and range of the function.
   b.) Write the equation of the function in piecewise notation.

12) Rearrange the quadratic equation $y = 4x^2 + 2x + 1$ to the form $y = a(x-p)^2 + q$ by completing the square.

13) Solve the following quadratic equation: $2x^2 + 8x - 3 = 0$

14) Solve the following system of equations algebraically:

$y = x + 7$

$y = x^2 - 49$

15) Solve the following inequalities:

a) $\dfrac{2}{3}(2-x) > \dfrac{1}{2} + x$

b) $x^2 - 16 < 6x$

c) Draw the graph of the solution to the following, including shading and correct solid vs. dashed line: $y > 3x - 2$

16) For the following oblique triangles, note that the placement test is no-calculator, so you may be asked to identify which formula (sine or cosine law) you would use, how you would manipulate the formula, and how to substitute numbers up to, but not including, any step that would require a calculator. (The answer key to this guide will show the last step before a calculator would be used, but will also show the final answer from a calculator so you can check your final work.)

a) If a = 6.2 cm, A = 65.0º, and B = 55.2º, solve for side c to the nearest tenth.

b) If a = 21.61 cm, b = 29.33 cm, and c = 42.57 cm, solve for the smallest angle in the triangle to the nearest tenth.

Grade 11 Mathematics content – for placement into
Grade 12 Math (Math 30-1/Math 182)
<u>Answer Key</u>

All graphs in this answer key were created with desmos.com.

1) a) $\dfrac{\sqrt{14}}{7}$ b) $\sqrt{106}$ c) $\dfrac{2a\sqrt[3]{2a}}{3}$ d) $6ab^3c^4d\sqrt{3ac}$

2) a) $114 - 48\sqrt{3}$ b) $\dfrac{2\sqrt{2} - \sqrt{5}}{6}$ c) $\dfrac{9\sqrt{2} - \sqrt{6}}{52}$

3) a) $x = 28$ b) $x = 3$ c) $x = 5$

4) a) $a + 2b$ b) $(x+1)(x^2+1)$ c) -3(n+3) or can write as $-3n - 9$

     d) $\dfrac{4a - 1}{a(a+2)}$ e) $\dfrac{28(x-3)}{3x^2(x+5)}$

5) a) $x = \dfrac{12}{7}$ b) $x = -6$ c) no solution   d) $x = 2/5$

6) a) $\dfrac{\sqrt{2}}{2}$ b) -1   c.) $\dfrac{1}{2}$ d.) $\dfrac{-1}{2}$ e.) 0   f.) 0   g.) -1   h.) undefined

7) $\sin\theta = \dfrac{2\sqrt{13}}{13}$ $\cos\theta = \dfrac{-3\sqrt{13}}{13}$ and $\tan\theta = \dfrac{-2}{3}$

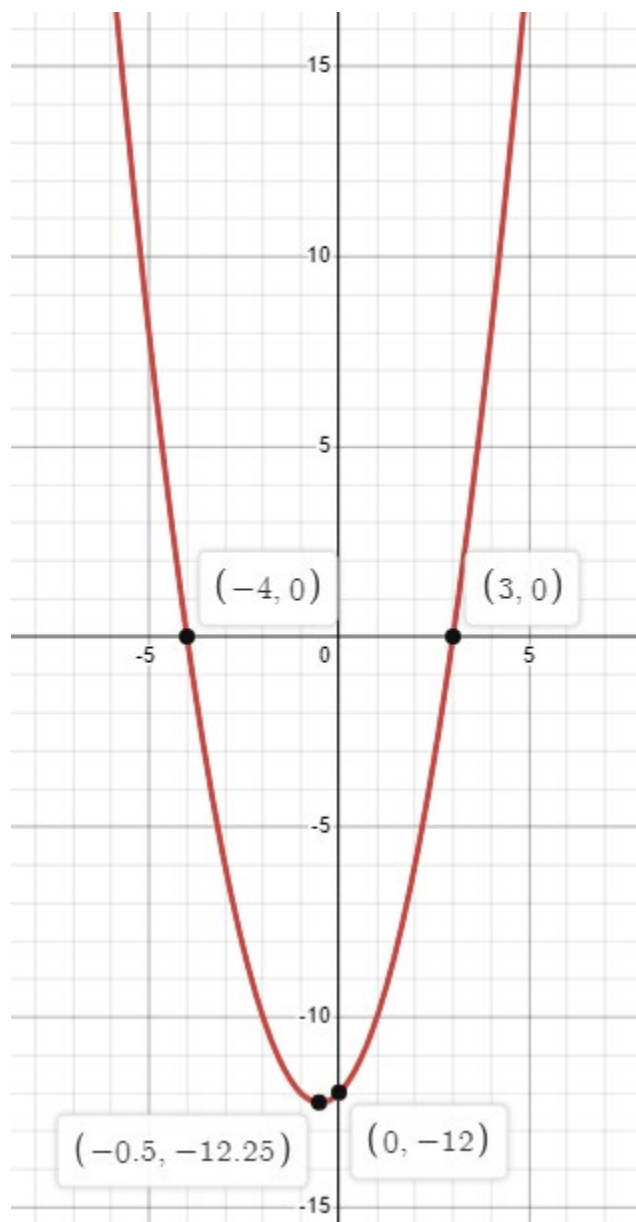**8)** 60°, 240°   b.) 150°, 210°   c.) 225°, 315°   d.) 270°   e.) 90°, 270°   f.) 90°, 270°

9) a.) $f(x) = x^2 + x - 12$:

x-int.: (-4,0), (3,0); y-int. = (0,-12)

vertex: (-1/2, -49/4) (note: -49/4 = -12.25)
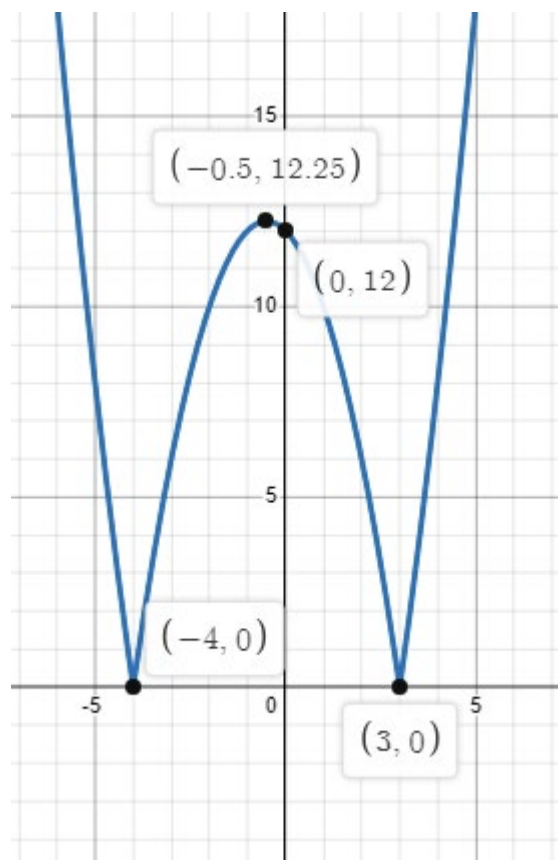
domain: $x \in \mathbb{R}$

range: $y \geq -49/4$

b.) $y = |f(x)| = |x^2 + x - 12|$

x-int.: (-4,0), (3,0); y-int. = (0,12)

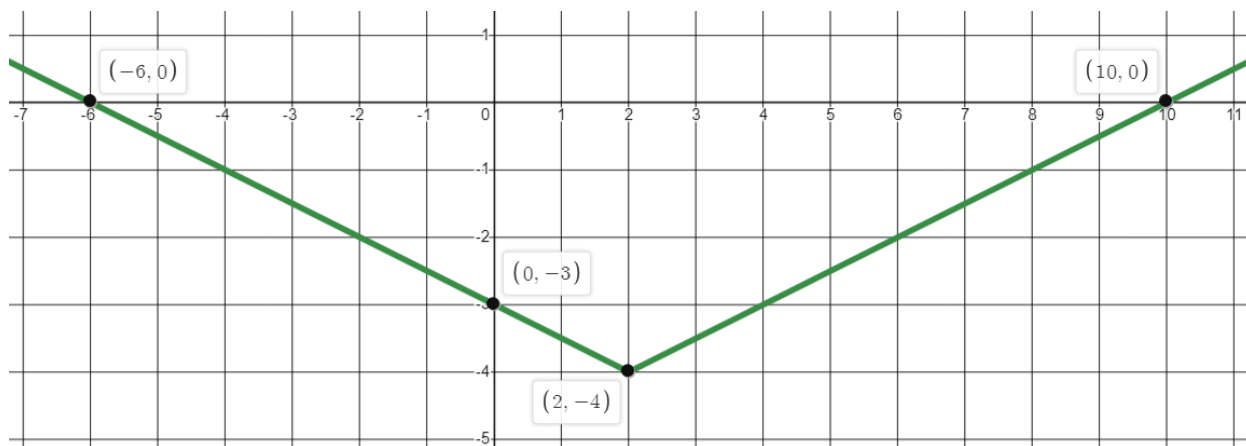vertex: (-1/2, 49/4) (note: 49/4 = 12.25)

domain: $x \in \mathbb{R}$

range: $y \geq 0$

10) $\left|-2\frac{1}{4}\right|, \left|-2\frac{1}{8}\right|, -\left|-2\frac{1}{4}\right|, -|2.5|$

11) $f(x) = \frac{1}{2}|x-2| - 4$

a.) x-int: (-6,0), (10,0); y-int: (0, -3); vertex: (2, -4); domain: $x \in \square$; range: y ≥ -4

b.) piecewise notation:

$$y = \begin{cases} -\dfrac{1}{2}x - 3, x \le 2 \\ \dfrac{1}{2}x - 5, x \ge 2 \end{cases}$$

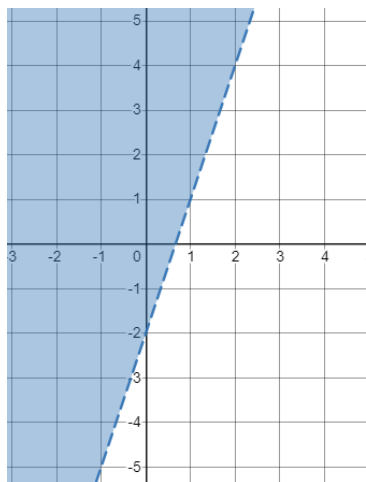**12)** $y = 4\left(x + \dfrac{1}{4}\right)^2 + \dfrac{3}{4}$

13) $x = \dfrac{-4 \pm \sqrt{22}}{2}$

14) (8,15) and (-7,0)

15) a) $x < \dfrac{1}{2}$

    b) $-2 < x < 8$

    c)

16) a) Last step expected for placement test (no calculator):

$$c = \frac{6.2 \sin 59.8^o}{\sin 65.0^o}$$

Final step if using a calculator: c = 5.9 cm

b) Last step expected for placement test (no calculator):

$$\cos A = \frac{21.61^2 - 29.33^2 - 42.57^2}{-2(29.33)(42.57)}$$ (and then take $\cos^{-1}$ of that value)

Final step if using a calculator: A = 28.0°

Grade 11 (20-1-level) Formula Sheet

for Placement Test (into Math 182)

$a^2 - b^2 = (a - b)(a + b)$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

$$c^2 = a^2 + b^2 - 2ab\cos C$$