



# **Academic Upgrading**

Academic Services

## **Study Guide for Placement into Grade 12 (Math 30-2/Math 162) Math**

Updated: July 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 162 (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 30-2 (Math 162). Use the following grade 11 practice exercises to prepare for your online placement test to meet eligibility for Math 30-2. An answer key is included at the end of this guide.

This test is for placement into grade 12 Math 30-2 equivalency (Math 162):

- 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 162
- 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 and probability table (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 182 (Mathematics 30-1 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).

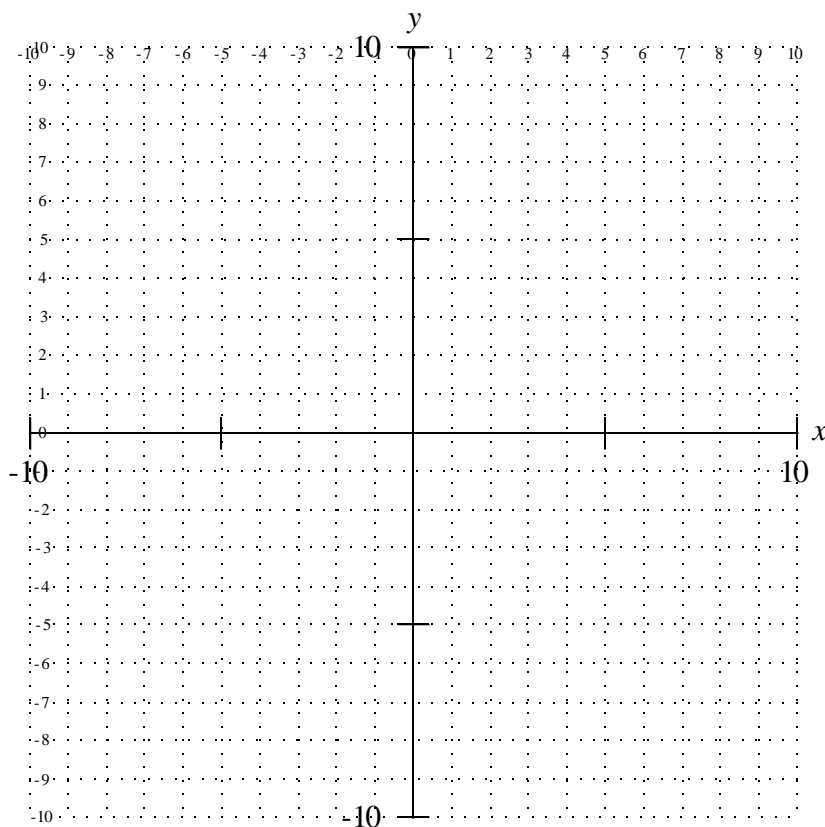
Please review your future program's math admission requirements on [www.sait.ca](http://www.sait.ca) to determine which math stream is most-suitable for your needs. For more details about these courses or the required testing scores to place into them, contact [upgrading@sait.ca](mailto:upgrading@sait.ca)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

## Grade 11 Mathematics content (Math 20-2) – Practice Exercises

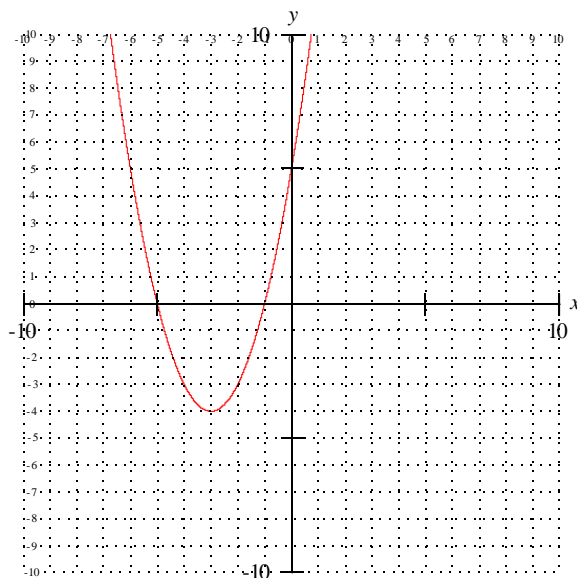
These will be similar to what you will be tested on in the placement test into Grade 12 (Math 30-2/Math 162) math.

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

1. A quadratic function is given by the equation,  $h(x) = 3x^2 + 12x - 15$ . Determine the domain and range of the function,  $h(x)$ .
2. Given the coordinate grid below, sketch the quadratic function,  $y = \frac{1}{2}(x-3)^2 - 2$ .



3. Consider the quadratic function,  $y = -6x^2 - 3x + 18$ . If the equation of the axis of symmetry is  $x = -0.25$ , determine the coordinates of the vertex of the graph.



4. What are the domain and range of the function given in the graph above?
- $\{x | x \in R\}, \{y | y \in R\}$
  - $\{x | x \in R\}, \{y | y \geq -4, y \in R\}$
  - $\{x | x \geq -4, x \in R\}, \{y | y \in R\}$
  - $\{x | x \in R\}, \{y | y > 4, y \in R\}$
5. Determine the exact value of the following expression and record your answer as a mixed radical

$$\sqrt{30} \times 2\sqrt{6}$$

6. Determine the exact value of the following expression and record your answer as a mixed radical

$$\frac{3\sqrt{40}}{\sqrt{12}}$$

7. Determine the exact value of the following expression and record your answer as a mixed radical

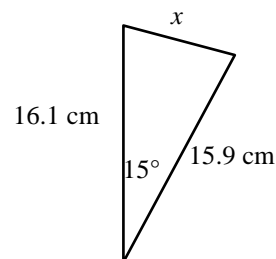
$$\frac{-\sqrt{20}}{\sqrt{3} - \sqrt{2}}$$

8. Surveyors are measuring a rectangular building site and determine its dimensions to be  $175\text{m} \times 50\text{m}$  wide. If a scale drawing of the land is constructed and is  $70\text{cm} \times 20\text{cm}$ , what is the scale factor for the drawing?

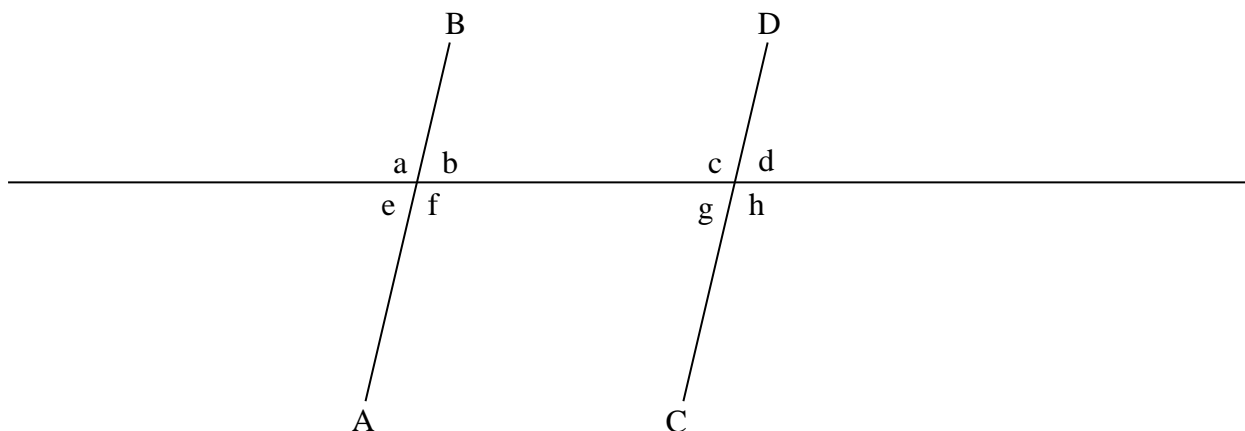
9. A can of pop (a cylinder) is 12.0cm tall and has a diameter of 5.5cm. An enlarged model of the pop can is to be constructed. The scale ratio to be used in the construction is 1:45. What will the enlarged model's height and diameter be and what will the ratio between the enlarged model's volume and the actual volume be?

10. What is the value of  $x$  for the triangle given to the right?

- a. 2.4cm
- b. 4.2cm
- c. 17.5cm
- d. 30.0cm



11. If  $\overline{AB} \parallel \overline{CD}$ , then which of the following statements concerning angles  $a$  through  $f$  is true in the diagram below?



- A.  $a = f = c = h$
- B.  $e = b = c = h$
- C.  $a = b = c = d$
- D.  $a = b = g = h$

12. From the top of a tall cliff an observer sees two boats, one directly behind the other, heading for the shore. The angle of depression from the observer to the boat farthest from the observer is  $42^\circ$  and the angle of depression to the nearer boat is  $51^\circ$ . If the distance between the observer and the closest boat is 125m, calculate, to the nearest meter, the distance between the boats. Your solution must include a clearly labelled diagram.

13. A student plans to make an open box from a sheet of cardboard by cutting squares from each corner, and then turning up the four flaps. The box is to be 3.0cm deep and 15.0cm longer than it is wide. Its volume is to be  $55.0\text{cm}^3$ . Find the dimensions of the box to the nearest tenth of a cm.
14. The height of Canadian adult females is normally distributed with a mean of 162 cm and a standard deviation of 9.4 cm. Determine the **minimum** height, to the nearest centimeter, a person could be and still be within the top 8%.
15. Students' scores on a final exam are normally distributed with a mean of 62% and a standard deviation of 5%. The instructor adjusts the marks so that the new mean is 70%, the new standard deviation is 10%, and the  $z$ -scores are unchanged. If Ahmed's original mark was 75%, then, to the nearest percent, determine his adjusted mark.

16.

**Key:**

Question 1:

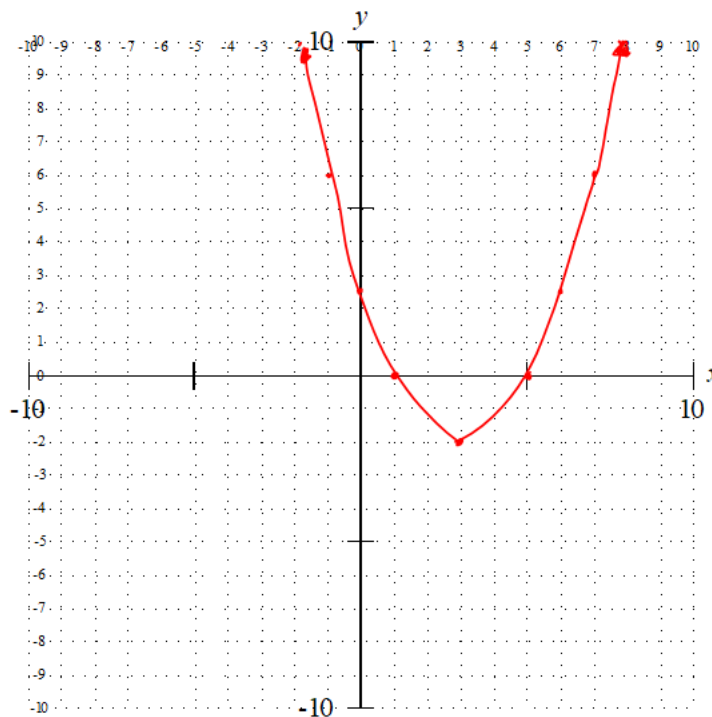
$$h(x) = (3x - 3)(x + 5) \text{ therefore } x\text{-intercepts are } x=1 \text{ and } x=-5$$

The vertex must have an  $x$ -coordinate of  $x=-2$

$$h(-2) = 3(-2)^2 + 12(-2) - 15$$

$$h(-2) = -27, \text{ this is the minimum, so } \begin{cases} x/ & x \in R \\ y/ & y \geq -27, y \in R \end{cases}$$

Question 2:



Question 3:

$$y(-0.25) = -6(-0.25)^2 - 3(-0.25) + 18$$

$$y(-0.25) = 18.375$$

$$\text{Vertex: } (-0.25, 18.375)$$

Question 4:

$$\{x \mid x \in R\}, \{y \mid y \geq -4, y \in R\}$$

Question 5:

$$= 2\sqrt{180}$$

$$= 2 \times 6\sqrt{5}$$

$$= 12\sqrt{5}$$

Question 6:

$$= 3\sqrt{\frac{40}{12}}$$

$$= 3\sqrt{\frac{10}{3}}$$

Question 7:



$$\begin{aligned} & \frac{-\sqrt{20}}{\sqrt{3}-\sqrt{2}} \times \frac{(\sqrt{3}+\sqrt{2})}{\sqrt{3}+\sqrt{2}} \\ &= \frac{-(\sqrt{60}+\sqrt{40})}{3-2} \\ &= -(2\sqrt{15}+2\sqrt{10}) \\ &= -2(\sqrt{15}+\sqrt{10}) \end{aligned}$$

Question 8:

$$(175 \text{ m})x = 0.7 \text{ m}$$

$$\text{and } (50 \text{ m})x = 0.2 \text{ m}$$

$$x = 0.7/175$$

$$x = 0.2/50$$

$$x = \frac{1}{250}$$

Question 9:

$$\text{height} = (12.0 \text{ cm}) 45$$

$$\text{height} = 540 \text{ cm}$$

$$\text{diameter} = (5.5 \text{ cm}) 45$$

$$\text{diameter} = 247.5 \text{ cm}$$

*The volume of the enlarged model will be  $45^3$  times higher =  $45 \times 45 \times 45 = 91125$*

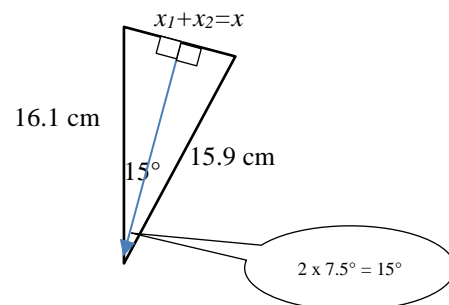
Question 10:

- a. 2.4cm
- b. 4.2cm
- c. 17.5cm
- d. 30.0cm

$$x_1 = 16.1 \text{ cm } (\text{Sin } 7.5)$$

$$x_1 = 2.101 \text{ cm}$$

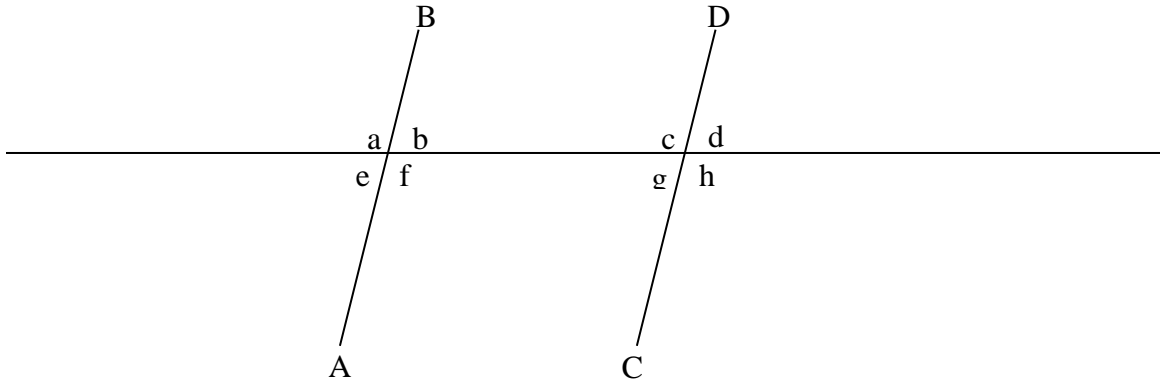
$$x_2 = 15.9 \text{ cm } (\text{Sin } 7.5)$$



$$x_2 = 2.075 \text{ cm}$$

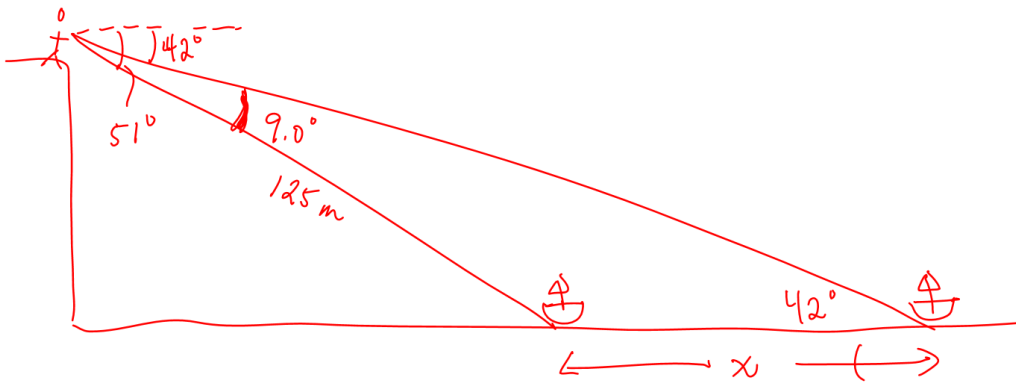
$$\therefore x = 4.2 \text{ cm}$$

Question 11.



- A.  $a = f = c = h$  ←  
 B.  $e = b = c = h$   
 C.  $a = b = c = d$   
 D.  $a = b = g = h$

Question 12.

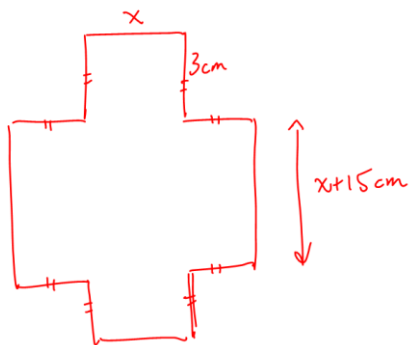


$$\frac{\sin 42^\circ}{125 \text{ m}} = \frac{\sin 9^\circ}{x}$$

$$x = 125 \text{ m} \times \frac{\sin 9^\circ}{\sin 42^\circ}$$

$$x = 29 \text{ m}$$

Question 13.



$$V = 3x(x + 15)$$

$$55 = 3x^2 + 45x$$

$$3x^2 + 45x - 55 = 0$$

$$x = \frac{-45 \pm \sqrt{45^2 - 4(3)(55)}}{2(3)}$$

$$x = \frac{-45 \pm \sqrt{2685}}{6}$$

$$x = -16.1 \text{ cm (not possible in this case) or } x = 1.1 \text{ cm}$$

$$\therefore x = 1.1 \text{ cm}$$

Question 14.

$$\text{invNorm}(0.92, 162, 9.4) = 175.2 \text{ cm}$$

$$\therefore \text{minimum height} = 176 \text{ cm}$$

Question 15.

$$\text{Z.Score} = \frac{75\% - 62\%}{5\%}$$

$$\text{Z.Score} = 2.6$$

$$\text{Z.Score} = \frac{\text{New mark} - \text{Mean } \mu}{\text{Standard deviation } \sigma} = \frac{x - \mu}{\sigma}$$

$$x = z(\sigma) + \mu$$

$$x = 2.6(10\%) + 70\%$$

$$x = 96\%$$

## Formula Sheet

### Factoring

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

### Quadratic Functions

$$y = ax^2 + bx + c \quad y = a(x - p)^2 + q \quad \text{or} \quad y = a(x - h)^2 + k \quad y = a(x - r)(x - s)$$

### Quadratic Equations

$$\text{For } ax^2 + bx + c = 0: x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

### Trigonometry

$$c^2 = a^2 + b^2 - 2ab \cos C \quad \frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

### Geometry

$$\text{Sum of interior angles of polygon} = 180^\circ(n - 2)$$

$$\text{Each interior angle of a regular polygon} = \frac{180^\circ(n - 2)}{n}$$

$$SA_{\text{cylinder}} = 2\pi r^2 + 2\pi r h \quad SA_{\text{cone}} = \pi r^2 + \pi r s \quad SA_{\text{sphere}} = 4\pi r^2$$

$$V_{\text{cylinder}} = \pi r^2 h \quad V_{\text{cone}} = \frac{1}{3} \pi r^2 h \quad V_{\text{sphere}} = \frac{4}{3} \pi r^3$$

$$V_{\text{pyramid}} = \frac{1}{3}(A_{\text{base}} \times h) \quad V_{\text{prism}} = A_{\text{base}} \times h$$

### Statistics

$$z = \frac{x - \mu}{\sigma} \quad \bar{x} = \frac{\sum x}{n} \quad \sigma = \sqrt{\frac{\sum (x - \bar{x})^2}{n}}$$

You will also need a graphing calculator OR a z-score table (standard normal distribution) for the exam.

## Probability table

STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	.50000	.50399	.50798	.51197	.51595	.51994	.52392	.52790	.53188	.53586
0.1	.53983	.54380	.54776	.55172	.55567	.55962	.56356	.56749	.57142	.57535
0.2	.57926	.58317	.58706	.59095	.59483	.59871	.60257	.60642	.61026	.61409
0.3	.61791	.62172	.62552	.62930	.63307	.63683	.64058	.64431	.64803	.65173
0.4	.65542	.65910	.66276	.66640	.67003	.67364	.67724	.68082	.68439	.68793
0.5	.69146	.69497	.69847	.70194	.70540	.70884	.71226	.71566	.71904	.72240
0.6	.72575	.72907	.73237	.73565	.73891	.74215	.74537	.74857	.75175	.75490
0.7	.75804	.76115	.76424	.76730	.77035	.77337	.77637	.77935	.78230	.78524
0.8	.78814	.79103	.79389	.79673	.79955	.80234	.80511	.80785	.81057	.81327
0.9	.81594	.81859	.82121	.82381	.82639	.82894	.83147	.83398	.83646	.83891
1.0	.84134	.84375	.84614	.84849	.85083	.85314	.85543	.85769	.85993	.86214
1.1	.86433	.86650	.86864	.87076	.87286	.87493	.87698	.87900	.88100	.88298
1.2	.88493	.88686	.88877	.89065	.89251	.89435	.89617	.89796	.89973	.90147
1.3	.90320	.90490	.90658	.90824	.90988	.91149	.91309	.91466	.91621	.91774
1.4	.91924	.92073	.92220	.92364	.92507	.92647	.92785	.92922	.93056	.93189
1.5	.93319	.93448	.93574	.93699	.93822	.93943	.94062	.94179	.94295	.94408
1.6	.94520	.94630	.94738	.94845	.94950	.95053	.95154	.95254	.95352	.95449
1.7	.95543	.95637	.95728	.95818	.95907	.95994	.96080	.96164	.96246	.96327
1.8	.96407	.96485	.96562	.96638	.96712	.96784	.96856	.96926	.96995	.97062
1.9	.97128	.97193	.97257	.97320	.97381	.97441	.97500	.97558	.97615	.97670
2.0	.97725	.97778	.97831	.97882	.97932	.97982	.98030	.98077	.98124	.98169
2.1	.98214	.98257	.98300	.98341	.98382	.98422	.98461	.98500	.98537	.98574
2.2	.98610	.98645	.98679	.98713	.98745	.98778	.98809	.98840	.98870	.98899
2.3	.98928	.98956	.98983	.99010	.99036	.99061	.99086	.99111	.99134	.99158
2.4	.99180	.99202	.99224	.99245	.99266	.99286	.99305	.99324	.99343	.99361
2.5	.99379	.99396	.99413	.99430	.99446	.99461	.99477	.99492	.99506	.99520
2.6	.99534	.99547	.99560	.99573	.99585	.99598	.99609	.99621	.99632	.99643
2.7	.99653	.99664	.99674	.99683	.99693	.99702	.99711	.99720	.99728	.99736
2.8	.99744	.99752	.99760	.99767	.99774	.99781	.99788	.99795	.99801	.99807
2.9	.99813	.99819	.99825	.99831	.99836	.99841	.99846	.99851	.99856	.99861
3.0	.99865	.99869	.99874	.99878	.99882	.99886	.99889	.99893	.99896	.99900
3.1	.99903	.99906	.99910	.99913	.99916	.99918	.99921	.99924	.99926	.99929
3.2	.99931	.99934	.99936	.99938	.99940	.99942	.99944	.99946	.99948	.99950
3.3	.99952	.99953	.99955	.99957	.99958	.99960	.99961	.99962	.99964	.99965
3.4	.99966	.99968	.99969	.99970	.99971	.99972	.99973	.99974	.99975	.99976
3.5	.99977	.99978	.99978	.99979	.99980	.99981	.99981	.99982	.99983	.99983
3.6	.99984	.99985	.99985	.99986	.99986	.99987	.99987	.99988	.99988	.99989
3.7	.99989	.99990	.99990	.99990	.99991	.99991	.99992	.99992	.99992	.99992
3.8	.99993	.99993	.99993	.99994	.99994	.99994	.99994	.99995	.99995	.99995
3.9	.99995	.99995	.99996	.99996	.99996	.99996	.99996	.99996	.99997	.99997

**STANDARD NORMAL DISTRIBUTION: Table Values Represent AREA to the LEFT of the Z score.**

Z	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
-3.9	.00005	.00005	.00004	.00004	.00004	.00004	.00004	.00004	.00003	.00003
-3.8	.00007	.00007	.00007	.00006	.00006	.00006	.00006	.00005	.00005	.00005
-3.7	.00011	.00010	.00010	.00010	.00009	.00009	.00008	.00008	.00008	.00008
-3.6	.00016	.00015	.00015	.00014	.00014	.00013	.00013	.00012	.00012	.00011
-3.5	.00023	.00022	.00022	.00021	.00020	.00019	.00019	.00018	.00017	.00017
-3.4	.00034	.00032	.00031	.00030	.00029	.00028	.00027	.00026	.00025	.00024
-3.3	.00048	.00047	.00045	.00043	.00042	.00040	.00039	.00038	.00036	.00035
-3.2	.00069	.00066	.00064	.00062	.00060	.00058	.00056	.00054	.00052	.00050
-3.1	.00097	.00094	.00090	.00087	.00084	.00082	.00079	.00076	.00074	.00071
-3.0	.00135	.00131	.00126	.00122	.00118	.00114	.00111	.00107	.00104	.00100
-2.9	.00187	.00181	.00175	.00169	.00164	.00159	.00154	.00149	.00144	.00139
-2.8	.00256	.00248	.00240	.00233	.00226	.00219	.00212	.00205	.00199	.00193
-2.7	.00347	.00336	.00326	.00317	.00307	.00298	.00289	.00280	.00272	.00264
-2.6	.00466	.00453	.00440	.00427	.00415	.00402	.00391	.00379	.00368	.00357
-2.5	.00621	.00604	.00587	.00570	.00554	.00539	.00523	.00508	.00494	.00480
-2.4	.00820	.00798	.00776	.00755	.00734	.00714	.00695	.00676	.00657	.00639
-2.3	.01072	.01044	.01017	.00990	.00964	.00939	.00914	.00889	.00866	.00842
-2.2	.01390	.01355	.01321	.01287	.01255	.01222	.01191	.01160	.01130	.01101
-2.1	.01786	.01743	.01700	.01659	.01618	.01578	.01539	.01500	.01463	.01426
-2.0	.02275	.02222	.02169	.02118	.02068	.02018	.01970	.01923	.01876	.01831
-1.9	.02872	.02807	.02743	.02680	.02619	.02559	.02500	.02442	.02385	.02330
-1.8	.03593	.03515	.03438	.03362	.03288	.03216	.03144	.03074	.03005	.02938
-1.7	.04457	.04363	.04272	.04182	.04093	.04006	.03920	.03836	.03754	.03673
-1.6	.05480	.05370	.05262	.05155	.05050	.04947	.04846	.04746	.04648	.04551
-1.5	.06681	.06552	.06426	.06301	.06178	.06057	.05938	.05821	.05705	.05592
-1.4	.08076	.07927	.07780	.07636	.07493	.07353	.07215	.07078	.06944	.06811
-1.3	.09680	.09510	.09342	.09176	.09012	.08851	.08691	.08534	.08379	.08226
-1.2	.11507	.11314	.11123	.10935	.10749	.10565	.10383	.10204	.10027	.09853
-1.1	.13567	.13350	.13136	.12924	.12714	.12507	.12302	.12100	.11900	.11702
-1.0	.15866	.15625	.15386	.15151	.14917	.14686	.14457	.14231	.14007	.13786
-0.9	.18406	.18141	.17879	.17619	.17361	.17106	.16853	.16602	.16354	.16109
-0.8	.21186	.20897	.20611	.20327	.20045	.19766	.19489	.19215	.18943	.18673
-0.7	.24196	.23885	.23576	.23270	.22965	.22663	.22363	.22065	.21770	.21476
-0.6	.27425	.27093	.26763	.26435	.26109	.25785	.25463	.25143	.24825	.24510
-0.5	.30854	.30503	.30153	.29806	.29460	.29116	.28774	.28434	.28096	.27760
-0.4	.34458	.34090	.33724	.33360	.32997	.32636	.32276	.31918	.31561	.31207
-0.3	.38209	.37828	.37448	.37070	.36693	.36317	.35942	.35569	.35197	.34827
-0.2	.42074	.41683	.41294	.40905	.40517	.40129	.39743	.39358	.38974	.38591
-0.1	.46017	.45620	.45224	.44828	.44433	.44038	.43644	.43251	.42858	.42465
-0.0	.50000	.49601	.49202	.48803	.48405	.48006	.47608	.47210	.46812	.46414