
Grade 12
Applied Mathematics
Standards Test

Written Test

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GRADE 12 APPLIED MATHEMATICS STANDARDS TEST

DESCRIPTION

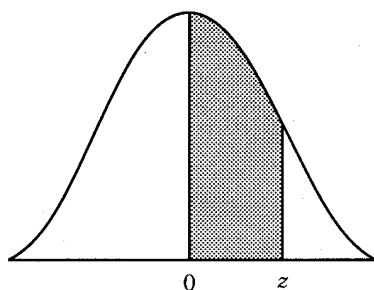
Total Possible Marks: 53

Time: 2.5 hours

	Description	Suggested Time	Marks
Section A	9 multiple-choice questions (1 mark each)	20 minutes	9
Section B	12 constructed-response questions (2 to 5 marks each)	130 minutes	44

TEST RESOURCES AND DIRECTIONS

- You are provided with the Standard Normal Distribution table on page 2.
- You may consult your 8½" × 11" individually prepared study sheet during the test.
- You may use a geometry set, a graphing calculator, computer software, and have access to the Internet for tools such as applets or a mortgage payment calculator. **Use of the Internet to access course notes, find definitions, or search for conceptual information about the course is prohibited during the test.**
- In Section A, choose the best response and mark it on the *Answer/Scoring Sheet*. Do not fold the *Answer/Scoring Sheet* or the test booklet.



Notes:

1. For values of z above 3.09, use 0.4999 for the area.
2. Use these common values that result from interpolation:

<u>z-score</u>	<u>area</u>
1.645	0.4500
1.960	0.4750
2.575	0.4950

Standard Normal Distribution										
z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.0000	0.0040	0.0080	0.0120	0.0160	0.0199	0.0239	0.0279	0.0319	0.0359
0.1	0.0398	0.0438	0.0478	0.0517	0.0557	0.0596	0.0636	0.0675	0.0714	0.0753
0.2	0.0793	0.0832	0.0871	0.0910	0.0948	0.0987	0.1026	0.1064	0.1103	0.1141
0.3	0.1179	0.1217	0.1255	0.1293	0.1331	0.1368	0.1406	0.1443	0.1480	0.1517
0.4	0.1554	0.1591	0.1628	0.1664	0.1700	0.1736	0.1772	0.1808	0.1844	0.1879
0.5	0.1915	0.1950	0.1985	0.2019	0.2054	0.2088	0.2123	0.2157	0.2190	0.2224
0.6	0.2257	0.2291	0.2324	0.2357	0.2389	0.2422	0.2454	0.2486	0.2517	0.2549
0.7	0.2580	0.2611	0.2642	0.2673	0.2704	0.2734	0.2764	0.2794	0.2823	0.2852
0.8	0.2881	0.2910	0.2939	0.2967	0.2995	0.3023	0.3051	0.3078	0.3106	0.3133
0.9	0.3159	0.3186	0.3212	0.3238	0.3264	0.3289	0.3315	0.3340	0.3365	0.3389
1.0	0.3413	0.3438	0.3461	0.3485	0.3508	0.3531	0.3554	0.3577	0.3599	0.3621
1.1	0.3643	0.3665	0.3686	0.3708	0.3729	0.3749	0.3770	0.3790	0.3810	0.3830
1.2	0.3849	0.3869	0.3888	0.3907	0.3925	0.3944	0.3962	0.3980	0.3997	0.4015
1.3	0.4032	0.4049	0.4066	0.4082	0.4099	0.4115	0.4131	0.4147	0.4162	0.4177
1.4	0.4192	0.4207	0.4222	0.4236	0.4251	0.4265	0.4279	0.4292	0.4306	0.4319
1.5	0.4332	0.4345	0.4357	0.4370	0.4382	0.4394	0.4406	0.4418	0.4429	0.4441
1.6	0.4452	0.4463	0.4474	0.4484	0.4495	0.4505	0.4515	0.4525	0.4535	0.4545
1.7	0.4554	0.4564	0.4573	0.4582	0.4591	0.4599	0.4608	0.4616	0.4625	0.4633
1.8	0.4641	0.4649	0.4656	0.4664	0.4671	0.4678	0.4686	0.4693	0.4699	0.4706
1.9	0.4713	0.4719	0.4726	0.4732	0.4738	0.4744	0.4750	0.4756	0.4761	0.4767
2.0	0.4772	0.4778	0.4783	0.4788	0.4793	0.4798	0.4803	0.4808	0.4812	0.4817
2.1	0.4821	0.4826	0.4830	0.4834	0.4838	0.4842	0.4846	0.4850	0.4854	0.4857
2.2	0.4861	0.4864	0.4868	0.4871	0.4875	0.4878	0.4881	0.4884	0.4887	0.4890
2.3	0.4893	0.4896	0.4898	0.4901	0.4904	0.4906	0.4909	0.4911	0.4913	0.4916
2.4	0.4918	0.4920	0.4922	0.4925	0.4927	0.4929	0.4931	0.4932	0.4934	0.4936
2.5	0.4938	0.4940	0.4941	0.4943	0.4945	0.4946	0.4948	0.4949	0.4951	0.4952
2.6	0.4953	0.4955	0.4956	0.4957	0.4959	0.4960	0.4961	0.4962	0.4963	0.4964
2.7	0.4965	0.4966	0.4967	0.4968	0.4969	0.4970	0.4971	0.4972	0.4973	0.4974
2.8	0.4974	0.4975	0.4976	0.4977	0.4977	0.4978	0.4979	0.4979	0.4980	0.4981
2.9	0.4981	0.4982	0.4982	0.4983	0.4984	0.4984	0.4985	0.4985	0.4986	0.4986
3.0	0.4987	0.4987	0.4987	0.4988	0.4988	0.4989	0.4989	0.4989	0.4990	0.4990

SECTION A: MULTIPLE-CHOICE QUESTIONS

Value: 9 marks

Suggested Time: 20 minutes

1. State the value of M_{32} if $[M] = [A] + [B]$.

$$A = \begin{bmatrix} 2 & 1 & 4 \\ 0 & -3 & 1 \\ -5 & 2 & -3 \end{bmatrix} \quad B = \begin{bmatrix} 4 & 2 & -2 \\ 1 & 0 & 1 \\ 3 & -2 & 4 \end{bmatrix}$$

- A) -2
- B) 0
- C) 1
- D) 2
2. Which of the following matrices is an example of a correct transition matrix?

A) $T = \begin{array}{c} \text{A} \quad \text{B} \\ \text{A} \begin{bmatrix} 0 & 0.20 \\ 0.80 & 0 \end{bmatrix} \\ \text{B} \end{array}$

B) $T = \begin{array}{c} \text{A} \quad \text{B} \\ \text{A} \begin{bmatrix} 0.60 & 0.40 \\ 0.80 & 0.30 \end{bmatrix} \\ \text{B} \end{array}$

C) $T = \begin{array}{c} \text{A} \quad \text{B} \\ \text{A} \begin{bmatrix} 0.70 & 0.20 \\ 0.30 & 0.80 \end{bmatrix} \\ \text{B} \end{array}$

D) $T = \begin{array}{c} \text{A} \quad \text{B} \\ \text{A} \begin{bmatrix} 0.70 & 0.30 \\ 0.20 & 0.80 \end{bmatrix} \\ \text{B} \end{array}$

3. Which of the following is the most liquid asset?

- A) \$10 000.00 in a chequing account
- B) \$10 000.00 in stocks
- C) \$10 000.00 in an RRSP
- D) \$10 000.00 in a mutual fund

4. Imagine that you are standing at the corner of 5th Street and Gilmour Street. How many ways can you get to the corner of 9th Street and Thornhill Street, if you travel on the streets and can only go south or west?



- A) 14
- B) 16
- C) 19
- D) 24

5. In how many different ways can all 5 letters of the word “GEESE” be arranged?
- A) 20
 - B) 40
 - C) 60
 - D) 120
6. Nicole’s z -score on an exam was 2.31. If the mean for the exam was 58% and the standard deviation was 7%, what was Nicole’s percentage mark?
- A) 41.83%
 - B) 58.33%
 - C) 61.03%
 - D) 74.17%
7. What is the minimum value of the following sinusoidal function?

$$y = 12 \sin(8.37x) + 36$$

- A) 12
- B) 24
- C) 36
- D) 48

8. A town with a population of 4000 people has an annual growth rate of 3.2%. What will its population be after 14 years?
- A) 6024
 - B) 6217
 - C) 6416
 - D) 195 027
9. George takes 500 mg of medication Monday morning. If his body eliminates 65% daily, how much medication will remain in his system Friday morning if he does not take any more medication?
- A) 2.63
 - B) 7.50
 - C) 89.25
 - D) 497.40

SECTION B: CONSTRUCTED-RESPONSE QUESTIONS

Value: 44 marks

Suggested Time: 130 minutes

DIRECTIONS

- There are 12 constructed-response questions in this section of the test. Each question is worth from 2 to 5 marks.
- Provide **complete answers** in the spaces provided in the test booklet. You may print out diagrams from the computer or your calculator where applicable. Indicate your booklet number and question number on the printouts. Remain seated and your teacher will distribute these printouts to you. Indicate in the response space of the question that the answer is on a printed sheet and staple it to the page.
- If you need more space to answer a question in Section B, extra paper may be provided by your teacher. Write your booklet number and question number on any extra paper used and staple it into the booklet where your answer begins. Indicate in the response space of the question that the answer is on a separate sheet.
- Provide clear explanations or justifications where applicable. This can be done through labelled diagrams, in words, by showing mathematical operations to verify your answer, or by referring to a calculator or software program.
 - If you refer to a calculator program, indicate your input values.
 - If you refer to a software program or a website, indicate your input values and print or copy the screen showing the answers.
 - If you refer to a spreadsheet, print a copy of the answers.
- Let the mark values for each question guide your time and the amount of detail you use in your answer.
- Round your final answers to the nearest two decimal places.
- Unless otherwise indicated, it is not necessary to draw diagrams to scale. If you draw a diagram to scale, make sure to indicate the scale you used.
- An answer without any work shown will be considered incomplete.
- Always state your assumptions.

**NO MARKS WILL BE AWARDED FOR WORK DONE
ON THIS PAGE.**

10. Julie decides to plant three different kinds of tomato plants: Beefsteak, Roma, and Tiny Tim. She wants to plant a different number of each kind in her garden and in her greenhouse as shown below.

Total:
3 marks

$$A = \begin{array}{l} \text{Beefsteak} \\ \text{Roma} \\ \text{Tiny Tim} \end{array} \begin{bmatrix} \text{Garden} & \text{Greenhouse} \\ 18 & 24 \\ 24 & 30 \\ 12 & 30 \end{bmatrix}$$

Each Beefsteak plant will produce 40 tomatoes, each Roma plant will produce 50 tomatoes, and each Tiny Tim plant will produce 20 tomatoes.

- a) Determine the number of tomatoes produced in her garden and in her greenhouse. Show your work using matrix operations.

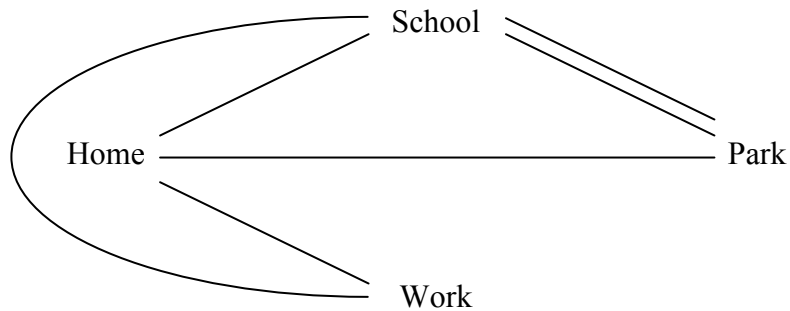
(2 marks)

- b) Julie wants to sell 60% of the tomatoes produced. Based on your answer in (a), determine the number of tomatoes she can sell from her garden and the number of tomatoes she can sell from her greenhouse.

(1 mark)

11. Allan sketches the following diagram to represent the sites on his walking routes:

Total:
4 marks



a) Create a direct route matrix R that represents the diagram above.

(1 mark)

$$R = \begin{array}{c} \text{Home} \\ \text{School} \\ \text{Park} \\ \text{Work} \end{array} \begin{array}{cccc} \text{Home} & \text{School} & \text{Park} & \text{Work} \\ \left[\begin{array}{cccc} & & & \\ & & & \\ & & & \\ & & & \end{array} \right] \end{array}$$

b) Determine the number of routes that Allan can take to go from the park to his work passing through exactly one other site. Show your work using matrix operations.

(2 marks)

- c) Allan thinks that he should calculate R^3 to determine the number of routes he could take to go from the park to his work passing through at most two other sites. Explain why Allan is wrong.

(1 mark)

12. Claire invests \$20 000.00 on her 25th birthday and plans to add \$2000.00 to her investment each year until her 40th birthday. The interest rate is 5.5% compounded annually.

Total:
4 marks

- a) What will be the value of Claire's investment on her 40th birthday? Show your work.
(2 marks)

- b) How much interest will her investment have earned by her 40th birthday?
(1 mark)

- c) Claire's friend suggests that she should have invested her money in the stock market. Do you agree or disagree with her friend? Explain your answer.
(1 mark)

13. Sylvie and Roland want to purchase a new house and can afford to make monthly payments of \$1000.00. They go to the bank and obtain a mortgage for \$195 000.00 compounded semi-annually and amortized over 25 years.

Total:
4 marks

- a) What is the interest rate (to 2 decimal places) of the mortgage? Show your work.

(2 marks)

- b) Sylvie and Roland wonder if it would be wise to find a less expensive house to reduce the amortization period to 20 years. Assuming that only the amortization period changes, what would be the maximum mortgage they could afford? Show your work.

(2 marks)

14. A student orders lunch at the school cafeteria. She must choose one of the four main courses (vegetables, chicken, beef, or pork) and one of the three desserts (cake, fruit, or ice cream).

Total:
2 marks

- a) Create a sample space to indicate all of the possibilities for lunch.

(1 mark)

- b) What is the probability that she will not order beef as a main course and will order cake or fruit for dessert?

(1 mark)

15. A survey of 65 students shows that:

Total:
4 marks

- 45 are enrolled in a Chemistry course
- 25 are enrolled in a Physics course
- 20 are enrolled in both a Chemistry and a Physics course

a) How many students are enrolled in only a Chemistry course?

(1 mark)

b) If a student is selected at random, what is the probability that the student is enrolled in a Chemistry or a Physics course? Show your work.

(2 marks)

c) Explain why these events are not mutually exclusive.

(1 mark)

16. The data below represents the ages (in years) of 20 trees in an area of natural vegetation.

Total:
3 marks

15	17	18	19	19	22	24	25	26	27
28	28	29	32	34	35	37	38	42	43

a) Determine the population standard deviation for this data (to 2 decimal places).

(1 mark)

b) Determine if this data represents a normal distribution. State 2 reasons to support your answer. Show your work using statistics.

(2 marks)

17. A survey of 1600 randomly selected Canadians showed that 74% of them have cellphones.

Total:
5 marks

- a) Calculate the mean and standard deviation for the number of Canadians who have cellphones.

(2 marks)

- b) Determine the 90% confidence interval for the Canadians who have cellphones. Show your work using statistics.

(2 marks)

- c) Explain what the confidence interval represents in this situation.

(1 mark)

18. The water levels (in metres above sea level) for one year at Cedar Lake are shown in the table below.

Total:
5 marks

Month	Water Level (metres above sea level)
January	838.9
February	836.2
March	833.0
April	833.6
May	836.0
June	838.4
July	840.2
August	841.3
September	842.1
October	841.2
November	841.2
December	838.4

- a) Assuming January is month 1, determine the sinusoidal equation that models this data using technology. Explain how you arrived at your answer.

(2 marks)

- b) The following sinusoidal equation represents the historic average water levels during the same months at Cedar Lake:

$$y = 2.68 \sin(0.54x + 2.76) + 838$$

Draw a clearly labelled graph to represent the historic average water levels for Cedar Lake for one year. Indicate the maximum and minimum values to 2 decimal places.

(2 marks)



maximum value = _____

minimum value = _____

- c) Scientists predict that climate change will have an impact on the water levels at Cedar Lake. Describe one possible change in climate and its effect on one of the values in the sinusoidal equation in (b).

(1 mark)

19. A stone gets stuck in the tire of a tractor plowing a field. The following sinusoidal equation models the height of the stone as the tire turns:

Total:
3 marks

$$y = 70 \sin(1.4x + 4.71) + 70$$

where y represents the height of the stone with respect to the ground (in cm)
and x represents the time (in seconds).

- a) How long does it take for the tire to make one complete rotation?

(1 mark)

- b) For how many seconds (to 2 decimal places) is the stone at least 120 cm above the ground during the first rotation of the tire? Show your work.

(2 marks)

20. Charles decides to start an ostrich farm with a population of 200 ostriches. The expected annual birth rate is 5%. Charles will purchase 50 additional ostriches each year.

Total:
4 marks

- a) If he sells 40% of the ostriches each year, how many ostriches will there be in the herd after 5 years? Show your work.

(2 marks)

- b) Charles must always keep a minimum of 76 ostriches on the farm. Will his plan maintain this level in the long term? Show your work to support your answer.

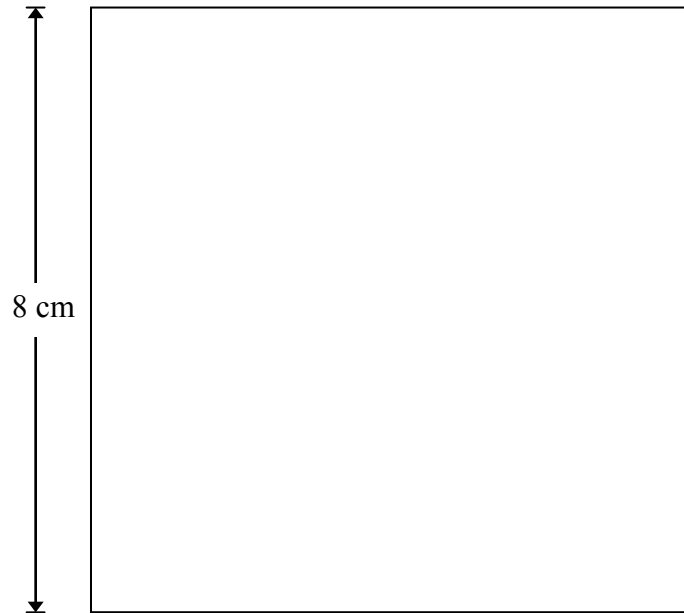
(2 marks)

21. a) Use the original square below to create a fractal given the following steps:

Total:
3 marks

1. Draw a diagonal line from the lower left corner to the upper right corner of the original square.
2. From the midpoint of the diagonal line, draw a horizontal line to the right side of the original square and a vertical line to the bottom of the original square, in order to create a new square.
3. Repeat steps 1 and 2 two more times with each new square.

(2 marks)



b) Determine the perimeter of the last square that was drawn.

(1 mark)

END OF TEST

**NO MARKS WILL BE AWARDED FOR WORK DONE
ON THIS PAGE.**

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