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Grade 12  
Applied Mathematics  
Standards Test

# Written Test

June 2009

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*Ce document est disponible en français.*

## GRADE 12 APPLIED MATHEMATICS STANDARDS TEST

### DESCRIPTION

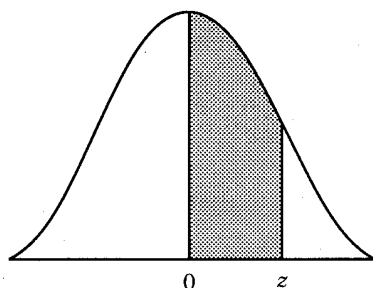
**Total Possible Marks: 53**

**Time: 2.5 hours**

	<b>Description</b>	<b>Suggested Time</b>	<b>Marks</b>
<b>Section A</b>	9 multiple-choice questions worth 1 mark each	20 minutes	9
<b>Section B</b>	12 constructed-response questions worth from 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 a mortgage payment calculator or applets. **The use of the Internet to access course notes, to find definitions, or to 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 Sheet*. Do not fold the *Answer 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><math>z</math>-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. A rugby league collected the following data. Each team received 3 points for a win, 2 points for a tie, 1 point for a forfeit, and 0 points for a loss.

	Win	Tie	Forfeit	Loss
<b>Raiders</b>	6	3	1	1
<b>Cardinals</b>	4	3	3	0
<b>Blue Hornets</b>	3	3	4	2
<b>Pirates</b>	2	1	7	1

Which of the following matrix operations would determine the total points for each team?

A) 
$$\begin{bmatrix} 6 & 3 & 1 & 1 \\ 4 & 3 & 3 & 0 \\ 3 & 3 & 4 & 2 \\ 2 & 1 & 7 & 1 \end{bmatrix} \times \begin{bmatrix} 3 \\ 2 \\ 1 \\ 0 \end{bmatrix}$$

B) 
$$\begin{bmatrix} 3 \\ 2 \\ 1 \\ 0 \end{bmatrix} \times \begin{bmatrix} 6 & 3 & 1 & 1 \\ 4 & 3 & 3 & 0 \\ 3 & 3 & 4 & 2 \\ 2 & 1 & 7 & 1 \end{bmatrix}$$

C) 
$$\begin{bmatrix} 6 & 3 & 1 & 1 \\ 4 & 3 & 3 & 0 \\ 3 & 3 & 4 & 2 \\ 2 & 1 & 7 & 1 \end{bmatrix} \times [3 \ 2 \ 1 \ 0]$$

D) 
$$[3 \ 2 \ 1 \ 0] \times \begin{bmatrix} 6 & 3 & 1 & 1 \\ 4 & 3 & 3 & 0 \\ 3 & 3 & 4 & 2 \\ 2 & 1 & 7 & 1 \end{bmatrix}$$

2. Which of the following directions would not be equal to a bearing of  $195^\circ$ ?

- A)  $15^\circ$  west of south
- B)  $15^\circ$  south of west
- C)  $W 75^\circ S$
- D)  $S 15^\circ W$

3. Which of the following is a semi-liquid asset?
- A) vehicle
  - B) cash
  - C) principal residence
  - D) mutual funds
4. Manitoba postal codes are made up of 3 letters and 3 digits which alternate (e.g., R7A 5A5). Determine the number of possible postal codes if each code must begin with the letter R and the letter O is not used.
- A) 397 440
  - B) 625 000
  - C) 9 936 000
  - D) 17 576 000
5. A six-sided number cube whose faces are numbered 1 to 6 and a coin are tossed. Which set below is not part of the sample space?
- Note: H = head, T = tail
- A) (1, H), (2, H), (2, T)
  - B) (H, 1), (T, 2), (H, 3), (T, 4), (T, 5)
  - C) (1, T), (3, T), (4, T), (5, T)
  - D) (1, H), (2, 3), (4, T), (H, T)

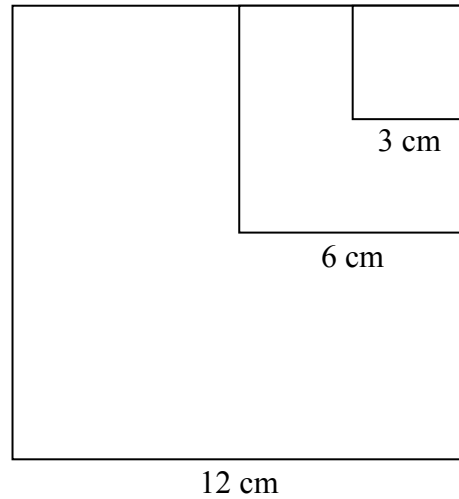
6. The table below shows the number of computers sold each month by a computer salesperson over a period of one year.

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Number of computers sold	12	8	6	5	5	6	8	11	10	9	7	10

Determine the population standard deviation.

- A) 2.25
- B) 2.35
- C) 3.64
- D) 8.08
7. The results of a test are normally distributed with a mean of 63% and a standard deviation of 4.3%. Determine the  $z$ -score for a mark of 72%.
- A) -2.09
- B) 2.09
- C) 4.50
- D) 57.35
8. A 500-gram sample of material loses 30% of its mass each month. How much material will be left after 4 months?
- A) 4.05 grams
- B) 84.04 grams
- C) 120.05 grams
- D) 171.50 grams

9. A sequence of squares is created as shown in the following diagram. If the sides of the 1st square have a length of 12 cm, what will be the length of the sides of the 10th square?  
(Diagram is not drawn to scale.)



- A) 0.0059 cm  
B) 0.01 cm  
C) 0.02 cm  
D) 0.05 cm

## 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 and staple them into the booklet where your answer begins. 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.
- 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. A town in Manitoba has 3 different committees: a finance committee, an improvement committee, and a social committee.

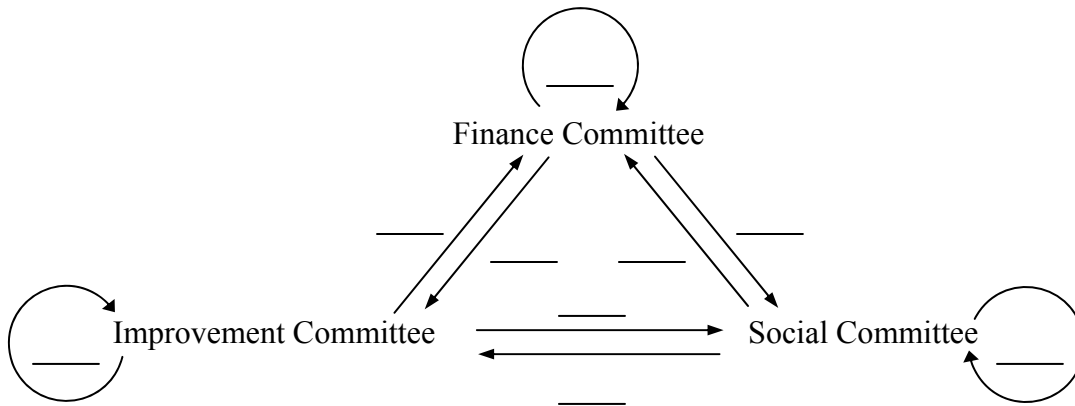
Total:  
4 marks

At the end of each year, members can change committees. Here are the last changes that took place:

- 50% of the members on the finance committee joined the social committee and 30% joined the improvement committee
- 30% of the members on the improvement committee joined the social committee and 20% joined the finance committee
- 50% of the members on the social committee joined the finance committee and 10% joined the improvement committee

a) Complete the transition diagram below.

(1 mark)



b) There are currently 20 members on the finance committee, 38 members on the improvement committee, and 15 members on the social committee. If the same changes take place, determine how many members will sit on each committee next year. Show your work using matrix operations.

(2 marks)

c) After several years, the number of members on the committees stabilizes. Explain why this happens.

(1 mark)

11. Sunny Day Care Centre provides a daily morning and afternoon snack for all the children who attend. Information on the snacks provided is shown below.

Total:  
4 marks

	Monday	Tuesday	Wednesday	Thursday	Friday
Morning Snack	16	16	8	20	12
Afternoon Snack	20	12	16	20	8

- a) A morning snack costs \$1.25 and an afternoon snack costs \$0.75. Determine the total cost of the snacks for each day of the week, not including taxes. Show your work using matrix operations.

(2 marks)

- b) The staff at Sunny Day Care Centre expects a 25% decrease in the number of children who attend during the summer months. Determine the number of morning and afternoon snacks required for each day of the week during the summer months. Show your work using matrix operations.

(2 marks)

12. Alice and Arthur have tied two ropes to a wagon. Alice pulls her rope with a force of 50 newtons in a direction of  $15^\circ$  west of north. Arthur pulls his rope with a force of 65 newtons in a direction of  $20^\circ$  north of west.

Total:  
4 marks

- a) Determine the magnitude and direction of the force exerted on the wagon. Show your work, including a scale vector diagram or a vector sketch.

(3 marks)

- b) Marie wants to stop Alice and Arthur from moving the wagon. In what direction must she pull to stop the wagon?

(1 mark)

13. A ship is travelling 65 km/h at a bearing of  $110^\circ$ . An ocean current is travelling 20 km/h in a direction of S  $10^\circ$  W.

Total:  
4 marks

- a) Draw a vector sketch, including magnitudes and directions, and determine the resultant speed of the ship.

*(3 marks)*

- b) The ship has enough fuel to travel for 3 hours and its destination is 220 km away. Will it reach its destination? Explain your answer.

*(1 mark)*

14. Denis and Lisa want to purchase a house for \$175 000.00. They have saved \$20 000.00 that they will use for a down payment. They obtain a mortgage from their bank at an interest rate of 5.5% compounded semi-annually for 25 years.

Total:  
3 marks

- a) Determine Denis and Lisa's monthly mortgage payment. Show your work.  
(2 marks)

- b) How much of the principal will they have paid after 10 years?  
(1 mark)

15. Louis and Claire just had a baby girl. They decide to make monthly contributions to a guaranteed investment certificate (GIC) in order to give her \$40 000.00 for her post-secondary education. The interest on the investment is calculated at 3.5% compounded monthly for 18 years.

Total:  
5 marks

- a) Determine Louis and Claire's monthly contribution. Show your work.

(2 marks)

- b) After graduating from high school, their daughter decides to travel for 2 years before going back to school. Louis and Claire decide to keep the \$40 000.00 in the GIC and continue making the same monthly contributions for 2 more years. How much added interest will be earned? Show your work.

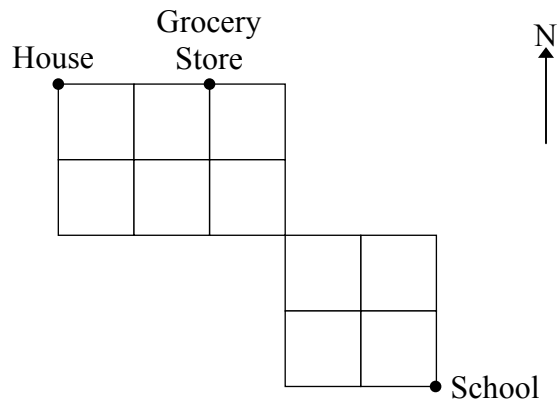
(2 marks)

- c) Their daughter suggests that they re-invest the \$40 000.00 in the stock market, rather than leaving it in the GIC. Explain why Louis and Claire might disagree with this suggestion.

(1 mark)

16. The following diagram shows all the possible routes between Martin's house, the grocery store, and the school.

Total:  
3 marks



- a) If Martin can only travel south or east, how many ways can he go directly from his house to the school? Show your work.

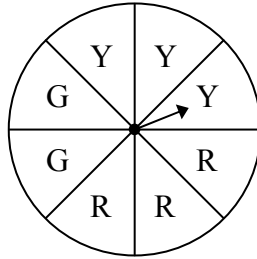
(2 marks)

- b) Martin's father asks him to go to the grocery store on his way home from school. If Martin can only travel north or west, how many ways can he get to his house by passing the grocery store?

(1 mark)

17. A spinner is divided into sections coloured green (G), red (R), and yellow (Y), as shown below. The spinner is spun once. Let A represent the event of the arrow landing on the colour yellow (Y).

Total:  
4 marks



- a) Determine the probability that event A will occur.  
(1 mark)
- b) Create a second event B and indicate its probability. The probability of event A and event B occurring must be between 0.1 and 0.2. Calculate the probability of both events occurring. Show your work.  
(3 marks)

18. The following data represents the goals scored per game by the Manitoba Moose:

Total:  
3 marks

<b>Goals scored per game</b>	0	1	2	3	4	5	6	7	8
<b>Frequency</b>	3	2	5	12	7	1	1	0	1

a) Determine the population standard deviation for the goals scored.

(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)

19. Transport Canada has found that, on average, 92% of Manitobans wear their seatbelts.

Total:  
3 marks

- a) During the month of July, police officers stop 1800 vehicles. Determine a 90% confidence interval for the drivers who are wearing their seatbelts when they are stopped by the police. Show your work using statistics.

*(2 marks)*

- b) Would the 95% confidence interval for this data be smaller, the same, or larger than the 90% confidence interval? Explain your answer.

*(1 mark)*

20. A doctor prescribes a medication to treat a medical condition. The patient takes 100 mg of medication on the first day and 50 mg of medication on the following days. The kidneys eliminate 25% of the medication from the patient's body every day.

Total:  
4 marks

- a) What quantity of medication will be present in the patient's body immediately after taking the medication on the 5th day? Show your work.

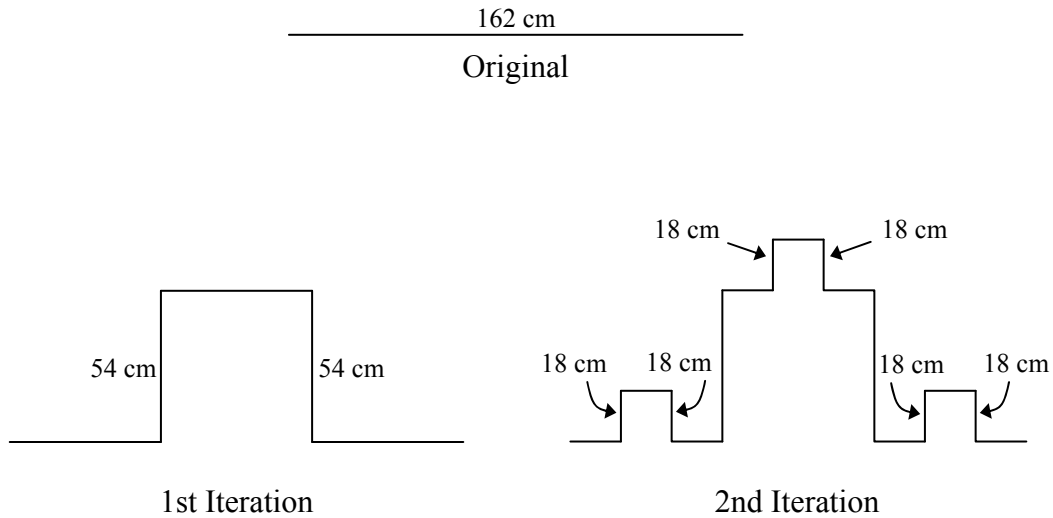
(2 marks)

- b) What quantity of medication should the patient take every day to reach a stabilization level of 150 mg? The level of medication is measured every day immediately after taking the medication. Show your work.

(2 marks)

21. The first 2 iterations of a fractal pattern are shown below. Three sides of a square are added to each new horizontal line segment. The original horizontal segment has a length of 162 cm and the length of the new sides added are  $\frac{1}{3}$  that of the original length. (Diagrams are not drawn to scale.)

Total:  
3 marks



- a) Determine the length of one of the new sides added in the 3rd iteration.

(1 mark)

b) Complete the following table.  
 (2 marks)

	<b>Total Length of New Sides Added (cm)</b>	<b>Total Length of Fractal Pattern (cm)</b>
<b>Original</b>	—	162
1st Iteration		
2nd Iteration		
3rd Iteration		
4th Iteration		
⋮	⋮	⋮
7th Iteration		

**END OF TEST**

**NO MARKS WILL BE AWARDED FOR WORK DONE  
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