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**Applications of  
Mathematics 12**

**JUNE 2003**

**Course Code = AMA**

### Student Instructions

1. Place the stickers with your Personal Education Number (PEN) in the allotted spaces above. **Under no circumstance is your name or identification, other than your Personal Education Number, to appear on this booklet.**
2. Ensure that in addition to this examination booklet, you have an **Examination Response Form**. Follow the directions on the front of the Response Form.
3. **Disqualification** from the examination will result if you bring books, paper, notes or unauthorized electronic devices into the examination room.
4. When instructed to open this booklet, **check the numbering of the pages** to ensure that they are numbered in sequence from page one to the last page, which is identified by  

**END OF EXAMINATION**

.
5. At the end of the examination, place your Response Form inside the front cover of this booklet and return the booklet and your Response Form to the supervisor.

Question 1a:  
1.  .   
(3)

Question 5a:  
9.  .   
(2)

Question 1b:  
2.  .   
(3)

Question 5b:  
10.  .   
(5)

Question 2:  
3.  .   
(4)

Question 5c:  
11.  .   
(3)

Question 3a:  
4.  .   
(3)

Question 5d:  
12.  .   
(2)

Question 3b:  
5.  .   
(2)

Question 5e:  
13.  .   
(1)

Question 4a:  
6.  .   
(2)

Question 6a:  
14.  .   
(4)

Question 4b:  
7.  .   
(2)

Question 6b:  
15.  .   
(5)

Question 4c:  
8.  .   
(2)

Question 6c:  
16.  .   
(3)

# **APPLICATIONS OF MATHEMATICS 12**

**JUNE 2003**

COURSE CODE = AMA

## GENERAL INSTRUCTIONS

1. Aside from an approved calculator, electronic devices, including dictionaries and pagers, are **not** permitted in the examination room.
2. All multiple-choice answers must be entered on the Response Form using an **HB pencil**. Multiple-choice answers entered in this examination booklet will **not** be marked.
3. For each of the written-response questions, write your answer in the space provided in this booklet.

You will not be provided with any additional paper since rough-work space for the written-response questions has been incorporated into the space allowed for answering each question. You may not need all of the space provided to answer each question.

4. Ensure that you use language and content appropriate to the purpose and audience of this examination. Failure to comply may result in your paper being awarded a zero.
5. This examination is designed to be completed in **two hours**. *Students may, however, take up to 30 minutes of additional time to finish.*

## APPLICATIONS OF MATHEMATICS 12 PROVINCIAL EXAMINATION

- |   | Value            | Suggested Time     |
|---|------------------|--------------------|
| 1. This examination consists of <b>three</b> parts: |                  |                    |
| PART A: 36 multiple-choice questions                | 54               | 60                 |
| PART B: 4 written-response questions                | 21               | 30                 |
| PART C: 2 Case Study questions                      | 25               | 30                 |
|   | <b>Total:</b>    |                    |
|   | <b>100 marks</b> | <b>120 minutes</b> |
2. The last **four** pages inside the back cover contain **Formulae, The Standard Normal Distribution Table, Rough Work for Graphing, and Rough Work for Multiple-Choice**. These pages may be detached for convenient reference prior to writing this examination.
3. **A graphing calculator is essential for the Applications of Mathematics 12 Provincial Examination.** The calculator must be a hand-held device designed primarily for mathematical computations involving logarithmic and trigonometric functions, for graphing functions and for performing statistical tests. Computers, calculators with a QWERTY keyboard or symbolic manipulation abilities, such as the Computer Algebraic System (CAS) and electronic writing pads will not be allowed. Students must not bring any external devices (peripherals) to support calculators such as manuals, printed or electronic cards, printers, memory expansion chips or cards, CD-ROMs, libraries or external keyboards. Students may have more than one calculator available during the examination. Calculators may not be shared and must not have the ability to either transmit or receive electronic signals. In addition to an approved calculator, students will be allowed to use rulers, compasses, and protractors during the examination.
- Calculators must not have any information programmed into the memory which would not be acceptable in paper form.* Specifically, calculators must not have any built-in notes, definitions, or libraries. There is no requirement to clear memories at the beginning of the examination but the use of calculators with built-in notes is equivalent to the use of notes in paper form. Any student deemed to have cheated on a provincial examination will receive a “0” on that examination and will be permanently disqualified from the Provincial Examination Scholarship Program.
4. If, in a justification, you refer to information produced by the calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem, it is important to sketch the graph, showing its general shape and indicating the appropriate window dimensions.
5. When using the calculator, you should provide a decimal answer that is correct to **at least two decimal places** (unless otherwise indicated). Such rounding should occur **only** in the final step of the solution.

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**PART A: MULTIPLE CHOICE**

**Value: 54 marks**

**Suggested Time: 60 minutes**

**INSTRUCTIONS:** For each question, select the **best** answer and record your choice on the Response Form provided. Using an HB pencil, completely fill in the circle that has the letter corresponding to your answer.

1. Which of the following matrices can be subtracted from matrix  $A_{2 \times 2}$  ?

- A.  $M_{2 \times 2}$
- B.  $M_{2 \times 3}$
- C.  $M_{3 \times 2}$
- D.  $M_{3 \times 3}$

2. For what value of  $k$  will the following equation be true?

$$k \begin{bmatrix} 1 & -2 \\ -3 & 4 \end{bmatrix} = \begin{bmatrix} -2 & 4 \\ 6 & -8 \end{bmatrix}$$

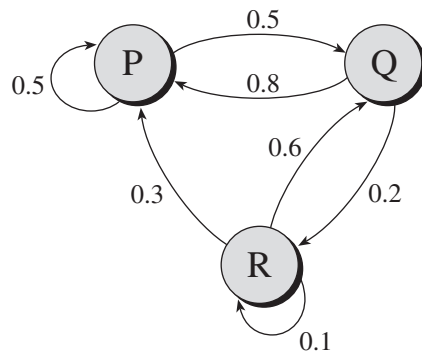
- A. -3
- B. -2
- C. 2
- D. 3

3. Determine  $(3Q)^2$  if  $Q = \begin{bmatrix} -1 & 1 \\ 1 & 2 \end{bmatrix}$ .

- A.  $\begin{bmatrix} 3 & 3 \\ 3 & 12 \end{bmatrix}$
- B.  $\begin{bmatrix} 6 & 3 \\ 3 & 15 \end{bmatrix}$
- C.  $\begin{bmatrix} 9 & 9 \\ 9 & 36 \end{bmatrix}$
- D.  $\begin{bmatrix} 18 & 9 \\ 9 & 45 \end{bmatrix}$

**OVER**

4. P, Q, and R represent three car rental locations. The diagram below shows the probabilities associated with rentals and returns to and from each location.



Which of the following is a transition matrix for this diagram?

- A. 

		To		
	From	P	Q	R
	P	0.5	0.5	0
	Q	0.8	0	0.2
	R	0.3	0.6	0.1
- B. 

		To		
	From	P	Q	R
	P	0	0.5	0.5
	Q	0.8	0	0.2
	R	0.3	0.6	0
- C. 

		To		
	From	P	Q	R
	P	0	1	0
	Q	0.8	0	0.2
	R	0.4	0.6	0
- D. 

		To		
	From	P	Q	R
	P	0	0.5	0.5
	Q	0.8	0.2	0
	R	0.1	0.6	0.3

5. Determine an expression for  $y$  for the following matrix multiplication.

$$\begin{bmatrix} 3 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} a & b \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} x & y \\ z & t \end{bmatrix}$$

- A.  $-a$   
 B.  $3a$   
 C.  $-b-2$   
 D.  $3b+1$



6. A computer room has 219 terminals. Initially, all terminals are working. Each day there is a 3% chance that a working terminal will break down and a 70% chance that a broken terminal will be repaired. In the long term, how many computers in the room should be working?
- A. 199
  - B. 210
  - C. 212
  - D. 219
7. Jennifer bought shares of Broax at \$50.85 for each share. A year later each share was worth \$5.18. What was the percent loss on the original investment over this one-year period?
- A. 10.2%
  - B. 11.3%
  - C. 88.7%
  - D. 89.8%

8. The spreadsheet below shows the beginning of the amortization schedule for a loan of \$9 500 at an interest rate of 6% per annum compounded monthly. The loan is to be paid off in 3 years with 36 equal monthly payments of \$289.01.

	A	B	C	D	E	F
1						
2	Principal	9500.00				
3	Interest rate	0.06				
4	Number of pmnts	36				
5	Monthly pmnts	289.01				
6						
7	Payment #	Balance	Monthly	Interest	Payment	Outstanding
8		before	Payment	Payment	to Princ.	Balance
9		Payment \$	\$	\$	\$	\$
10						9500.00
11	1	9500.00	289.01			
12	2					
13	3					
14	4					
15	5					

Determine the value that should appear in cell F11.

- A. 9 210.99  
 B. 9 258.49  
 C. 9 363.54  
 D. 9 452.50
9. Danielle wants to purchase a boat valued at \$26 000 by making monthly payments over a three-year period with no down payment. If the interest rate is 4% per year, compounded monthly, determine her monthly payment.
- A. \$751.11  
 B. \$767.62  
 C. \$775.38  
 D. \$814.14
10. Determine the vertical shift of the graph of  $y = 2 \sin 3(x + 4) + 5$  with respect to the graph of  $y = \sin x$ .
- A. 2  
 B. 3  
 C. 4  
 D. 5

11. Determine the phase shift (horizontal shift) of the graph of  $y = \sin\left(3x + \frac{\pi}{2}\right) + 4$ .

- A.  $\frac{\pi}{2}$  to the left
- B.  $\frac{\pi}{2}$  to the right
- C.  $\frac{\pi}{6}$  to the left
- D.  $\frac{\pi}{6}$  to the right

12. According to statistical data, the rodent population,  $r$ , in a certain region varies sinusoidally and can be modelled by the function  $r(t) = 300 \sin\left(\frac{\pi t}{2}\right) + 1\,200$ , where  $t$  is the number of years since 1990. Use this function to predict the maximum rodent population in this region.

- A. 1 200
- B. 1 350
- C. 1 500
- D. 1 800

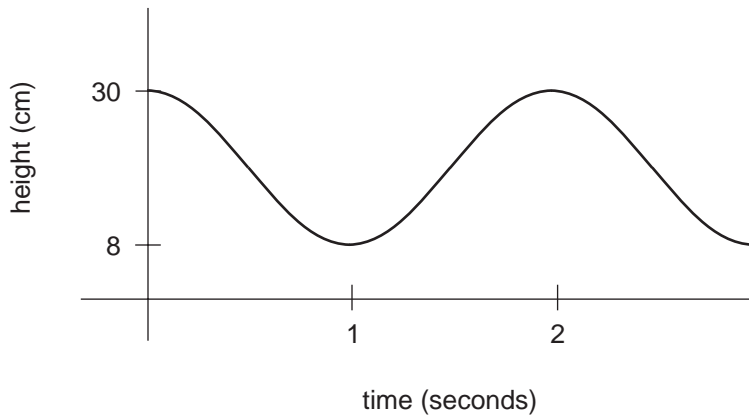
13. The following equation provides an estimate of the average monthly temperature in a northern village.

$$T = 22.5 \sin(0.53 M - 1.9) - 12$$

If  $T$  is the temperature ( $^{\circ}\text{C}$ ) and  $M$  is the number of the month of the year (January is 1, February is 2, ...), what is the average monthly temperature for June in degrees Celsius?

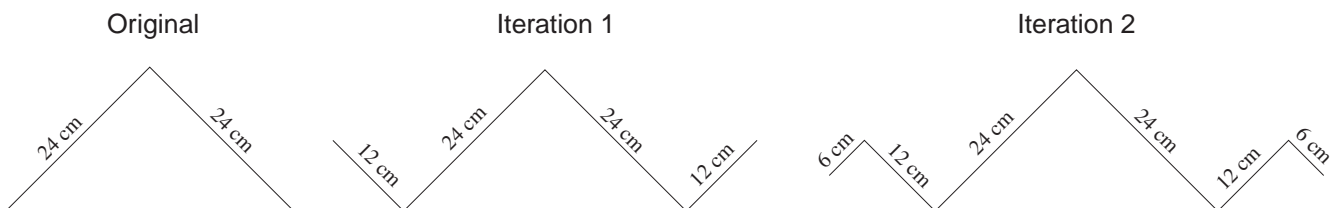
- A. 3.1
- B. 3.3
- C. 9.6
- D. 9.9

14. The height of a bicycle pedal above the ground can be modelled by the sinusoidal function graphed below.



Determine the amplitude of this function.

- A. 11 cm  
 B. 19 cm  
 C. 22 cm  
 D. 30 cm
15. A fractal is created as shown below. Each new set of sides, at right angles to the previous side, is one-half the length of the previous side. Determine the length of the smallest side created in the 8<sup>th</sup> iteration.

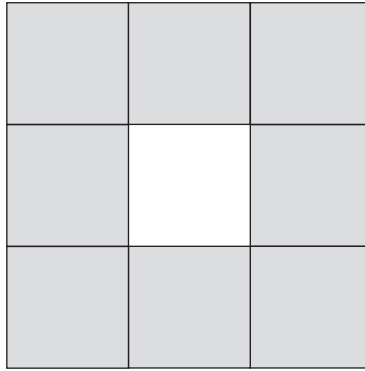


- A.  $\frac{3}{16}$  cm  
 B.  $\frac{3}{32}$  cm  
 C.  $\frac{3}{64}$  cm  
 D.  $\frac{3}{128}$  cm

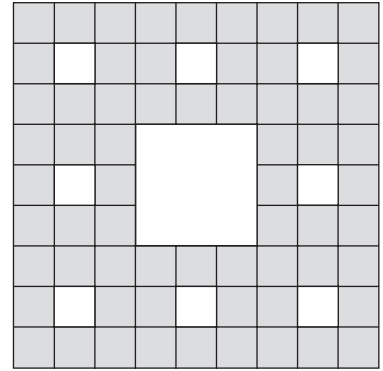
16. The diagram below illustrates the fractal pattern known as the Sierpinski carpet.



Initial Stage



Iteration 1

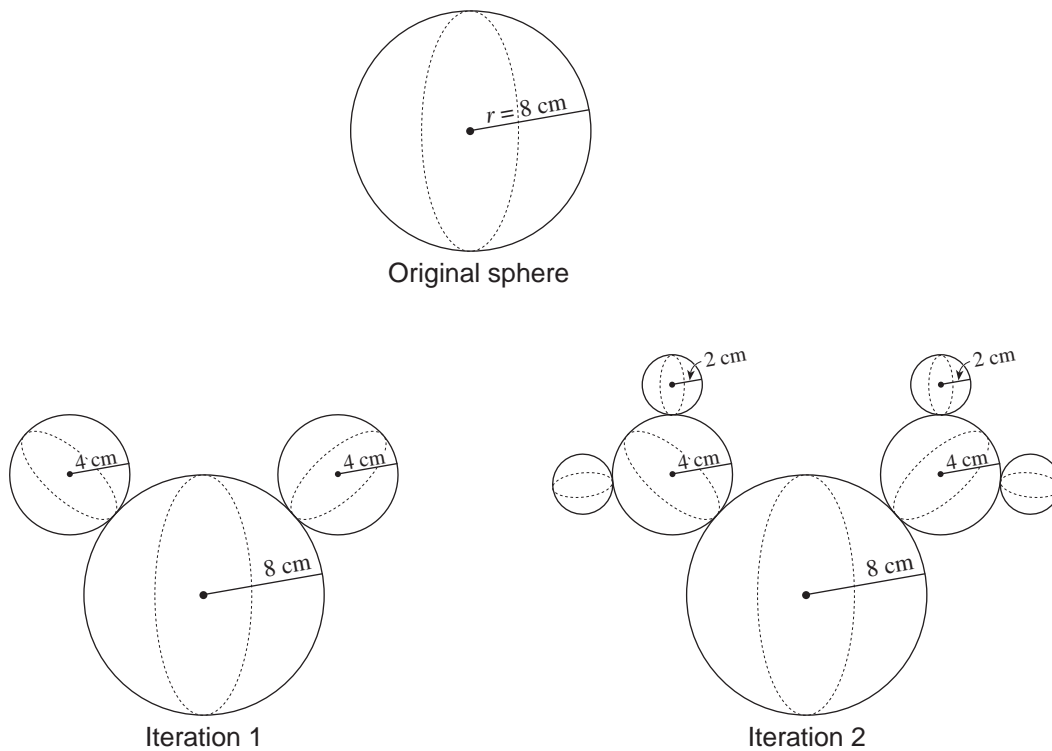


Iteration 2

How many shaded squares are in iteration 4?

- A.  $2^9 = 512$
- B.  $3^6 = 729$
- C.  $4^5 = 1\,024$
- D.  $8^4 = 4\,096$

17. The diagram below shows the first three patterns of a fractal consisting of spheres.

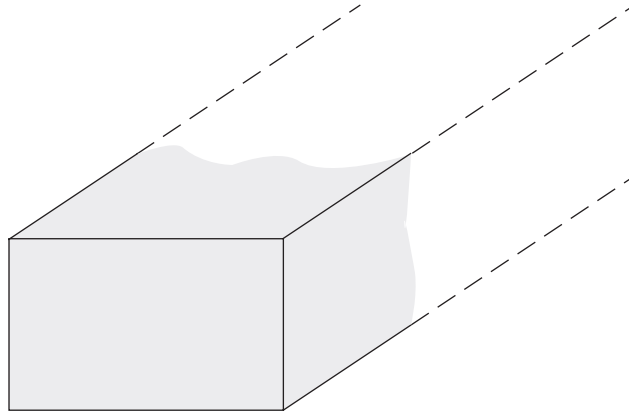


	<b>Radius</b>	<b>Surface Area</b>
Original sphere	8 cm	$256\pi$
Each <b>new</b> sphere in Iteration 1	4 cm	$64\pi$
Each <b>new</b> sphere in Iteration 2	2 cm	$16\pi$

If this pattern is continued forever, what is the total **surface area** of all the spheres in the fractal (in  $\text{cm}^2$ )?

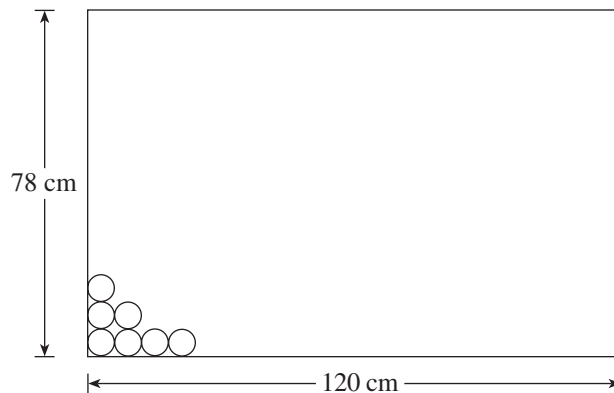
- A.  $\frac{1\,024\pi}{3} \approx 1\,072$
- B.  $384\pi \approx 1\,206$
- C.  $512\pi \approx 1\,608$
- D.  $\frac{16\,384\pi}{21} \approx 2\,451$

18. A contractor is ordering concrete for the foundation footing of a house. The foundation footing is 40 cm wide and 25 cm high.



If 70 metres of footing are required and concrete costs  $\$85.00/\text{m}^3$ , determine the approximate cost of the concrete for the foundation footing.

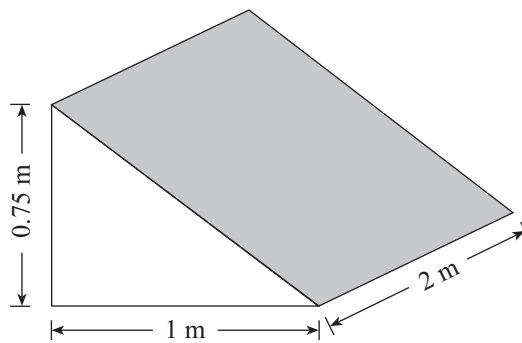
- A.  $\$250$   
B.  $\$550$   
C.  $\$600$   
D.  $\$825$
19. Circular disks with a diameter of 6 cm are punched from a sheet of metal measuring  $78\text{ cm} \times 120\text{ cm}$ , as shown in the diagram. Determine the maximum number of disks that can be punched from this sheet.



- A. 260  
B. 331  
C. 496  
D. 1 040

20. Determine the cost of plastering the walls and ceiling of a banquet room 12 m long, 10 m wide and 6 m high if the cost is \$9.75 per square metre. Subtract  $75 \text{ m}^2$  for doors and windows.
- A. \$1 842.75
  - B. \$3 012.75
  - C. \$3 744.00
  - D. \$4 182.75

21. A skateboard ramp is set up as shown in the diagram below.

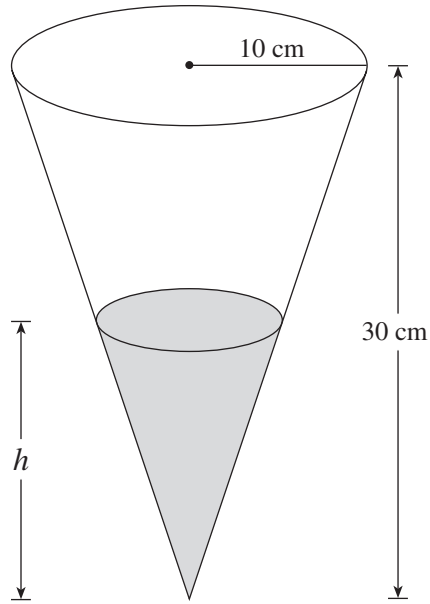


Determine the area of the shaded part of the ramp.

- A.  $1.5 \text{ m}^2$
- B.  $2.0 \text{ m}^2$
- C.  $2.5 \text{ m}^2$
- D.  $3.1 \text{ m}^2$



22. If 250 mL of water is poured into a cone with radius 10 cm and height 30 cm, what is the height,  $h$ , of the water in the cone?

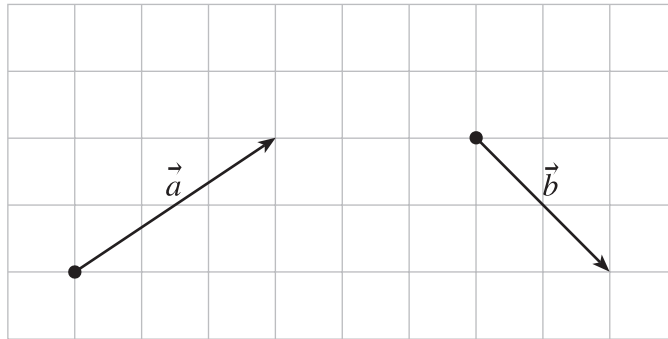


- A. 4.30 cm
- B. 8.48 cm
- C. 9.15 cm
- D. 12.90 cm

23. Which of the following is a vector quantity?

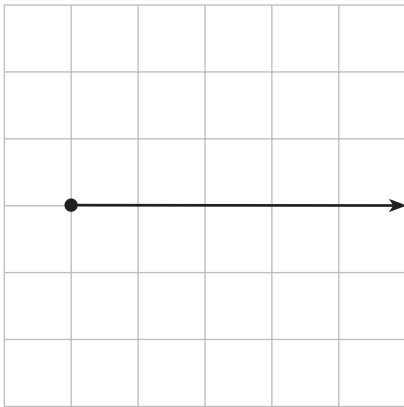
- A. a mass of 300 kg
- B. a distance of 15 km
- C. a speed of 75 km/h
- D. a force of 12 N downward

24. The diagram below illustrates vectors  $\vec{a}$  and  $\vec{b}$ .

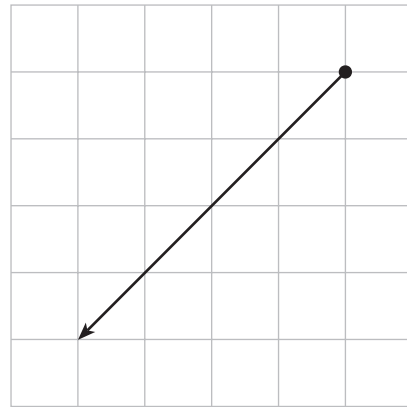


Which diagram illustrates vectors  $\vec{a} + (-\vec{b})$ ?

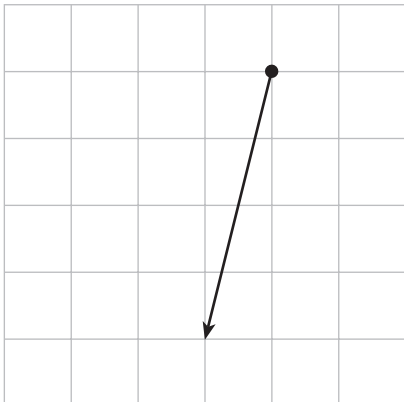
A.



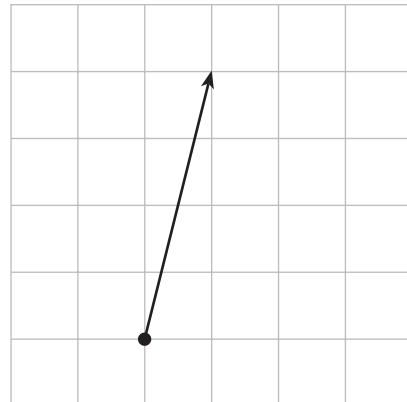
B.



C.



D.

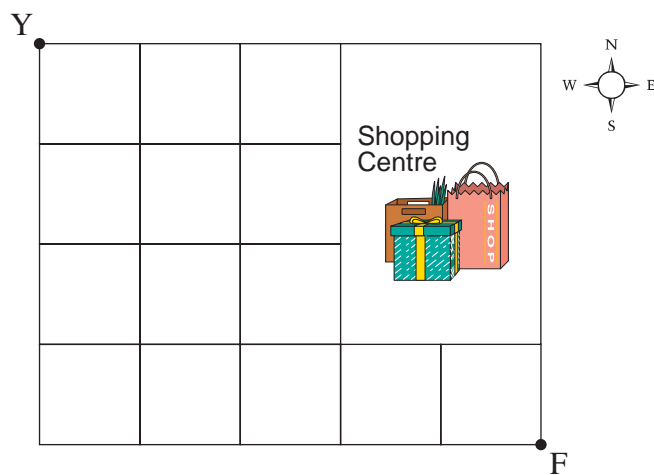


25. Which of the following numbers cannot describe the probability of an event?
- A.  $-\frac{1}{2}$
  - B. 0
  - C.  $\frac{1}{2}$
  - D. 1
26. In an experiment two fair dice are rolled. Which of the following events are mutually exclusive?
- A. rolling doubles with a sum of 3
  - B. rolling doubles with a sum of 4
  - C. rolling doubles with a sum of 6
  - D. rolling doubles with a sum of 8
27. Determine the probability of selecting an even-numbered card  $\{2, 4, 6, 8, 10\}$  in a single draw from a standard deck of 52 cards.
- A.  $\frac{10}{52}$
  - B.  $\frac{20}{52}$
  - C.  $\frac{26}{52}$
  - D.  $\frac{40}{52}$
28. Most truck licence plates in British Columbia have four numbers followed by two letters (e.g. 7251 JB). If the only restrictions are that the first digit cannot be zero and the letter O cannot be used, determine the number of plates that are possible.
- A. 5 625 000
  - B. 5 850 000
  - C. 6 250 000
  - D. 6 760 000

29. If a fair coin is tossed 5 times, what is the probability that the coin lands heads up at least once?

- A.  $\frac{4}{5}$
- B.  $\frac{13}{16}$
- C.  $\frac{15}{16}$
- D.  $\frac{31}{32}$

30. The diagram below shows the roads leading from your house, Y, to a friend's house, F. How many ways are there to get from your house to your friend's if you travel only east and south and stay on the road?



- A. 15
- B. 60
- C. 76
- D. 126

31. Ann, Billy and Carl are students in a class of 30. What is the probability that any group of 3 students selected from this class does not include any of Ann, Billy or Carl?

- A. 0.70
- B. 0.72
- C. 0.73
- D. 0.90

32. A game of chance requires a player to roll 2 fair dice. The player wins if both dice show odd numbers or if both dice show the same number. What is the probability a player will win?
- A.  $\frac{1}{3}$
  - B.  $\frac{3}{8}$
  - C.  $\frac{5}{12}$
  - D.  $\frac{4}{9}$

33. The table below shows the number of homes sold per month by a real estate agent over a one-year period.

Number of homes sold per month	Frequency
1	2
2	0
3	4
4	2
5	4

Determine the mean number of homes sold.

- A. 2.8
- B. 3.0
- C. 3.5
- D. 4.0

34. Determine the  $z$ -score for a score of 142, if the mean is 176 and the standard deviation is 18.
- A.  $-7.89$
  - B.  $-1.89$
  - C.  $1.89$
  - D.  $7.89$
35. On a Math test, the mean score was 71% with a standard deviation of 8.7. If 200 students wrote the test, how many would score below 65%?
- A. 45
  - B. 49
  - C. 53
  - D. 130
36. Determine the percentage of scores that lie within one standard deviation of a  $z$ -score of 0.3.
- A. 34%
  - B. 37%
  - C. 66%
  - D. 68%

**This is the end of the multiple-choice section.  
Answer the remaining questions directly in this examination booklet.**

## PART B: WRITTEN RESPONSE

Value: 21 marks

Suggested Time: 30 minutes

**INSTRUCTIONS:** Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question. Where required, place the final answer for each question in the space provided.

If, in a justification, you refer to information produced by the calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem, it is important to sketch the graph, showing its general shape and indicating the appropriate window dimensions.

When using the calculator, you should provide a decimal answer that is correct to **at least two decimal places** (unless otherwise indicated). Such rounding should occur **only** in the final step of the solution.

**Full marks will NOT be given for the final answer only.**

1. A basketball team is playing in a tournament. The probability that they will win their first game is 70%. Their coach has observed that if the team wins a game, the probability that they will win their next game is 80%. However, if the team loses a game, the probability that they will win their next game falls to 40%.
- a) Write the initial probability matrix and the transition matrix which could be used to predict the team's wins and losses in future games. **(3 marks)**

ANSWER:



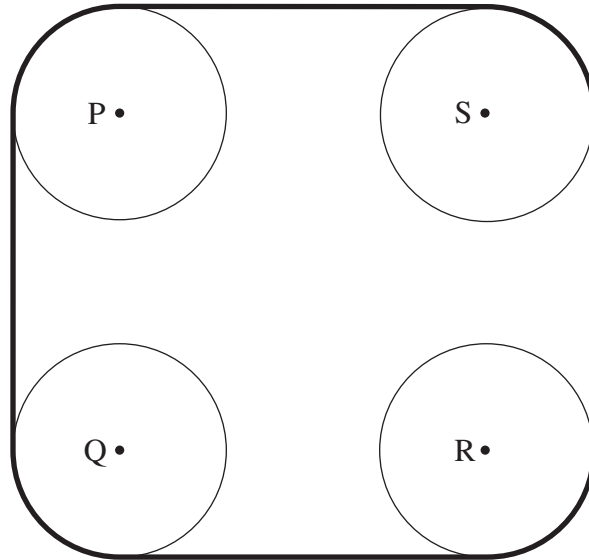
b) Determine the probability the team will lose its third game.

**(3 marks)**

ANSWER:

**OVER**

2. Four pulleys, each with a diameter of 12 cm, are connected by a belt, as shown in the diagram. The centres of pulleys P, Q, R, and S form a square. The distance between centres P and Q is 36 cm. Determine the total length of the belt around the outside of the pulleys. **(4 marks)**



ANSWER:

**OVER**

3. The height,  $h$ , in metres of a Ferris wheel seat above the ground varies sinusoidally with time. The radius of the Ferris wheel is 20 m, the wheel makes one rotation every 24 s, and the lowest height of the seat is 1 m above the ground. Bill is riding this Ferris wheel, which stops periodically to let other riders on. At one stop, Bill is at a height of 21 m above the ground. When the ride resumes, Bill moves upward.
- a) Determine a sinusoidal function to describe Bill's height above the ground as a function of time. **(3 marks)**

ANSWER:

- b) Determine Bill's height above the ground 15 s after the Ferris wheel starts moving again.  
(2 marks)

ANSWER:

**OVER**

4. A multiple-choice test has five questions with four choices for each question. A student guesses at all the answers without reading any of the questions.

a) What is the probability she will get all the answers correct? **(2 marks)**

ANSWER:
---------

b) What is the probability she will get exactly three answers correct? **(2 marks)**

ANSWER:
---------

c) What is the probability she will get three or more answers correct?

**(2 marks)**

ANSWER:

**OVER**

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## PART C: CASE STUDIES

Value: 25 marks

Suggested Time: 30 minutes

**INSTRUCTIONS:** Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question. Where required, place the final answer for each question in the space provided.

If, in a justification, you refer to information produced by the calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem, it is important to sketch the graph, showing its general shape and indicating the appropriate window dimensions.

When using the calculator, you should provide a decimal answer that is correct to **at least two decimal places** (unless otherwise indicated). Such rounding should occur **only** in the final step of the solution.

**Full marks will NOT be given for the final answer only.**

5. Megan is buying a car and has agreed on the purchase price of \$18 000. She will receive \$5 500 as a trade-in value for her old car. She will only have to pay one tax (PST at 7.5%) on the amount after the trade-in has been deducted.

a) What is the cost of her new car, including taxes, after trade-in?

**(2 marks)**

ANSWER:

- b) Megan has an additional \$1 000 which she intends to use as a down payment. She is trying to choose between a 2-year or a 3-year loan to finance the balance of her purchase. Given that the bank offers a rate of 4% per annum compounded semi-annually, with payments at the end of each month, complete the table below.

**(5 marks)**

	2-year loan	3-year loan
Loan amount after down payment		
Monthly payment		
Total of all payments		
Interest paid		

c) Megan calculates her operating costs as follows:

- driving to and from work = 48 km per day for 200 days per year
- pleasure = 6 000 km per year
- gas consumption = 8.3 litres per 100 km
- cost of gas = 62.9 cents per litre

Determine her average monthly fuel cost.

**(3 marks)**

ANSWER:

d) Megan's insurance will cost \$1 485 per year. If Megan chooses the 3-year loan, determine her total **monthly** cost to operate her vehicle (including her loan, fuel and insurance).

**(2 marks)**

ANSWER:

e) Give two other factors Megan might include in determining the cost of owning and operating her car for a year.

**(1 mark)**

i) \_\_\_\_\_

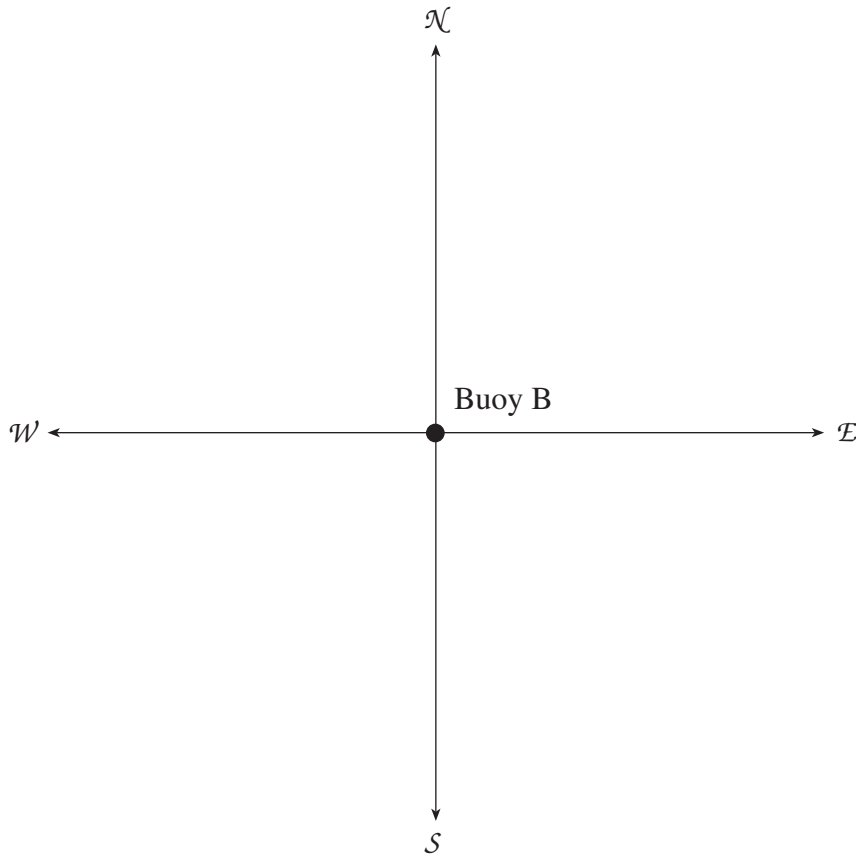
ii) \_\_\_\_\_

**OVER**

6. The navigation buoys in Georgian Bay are located at the corners of a right triangle.

- Buoy C is 2.3 km at a bearing of  $140^\circ$  from buoy B.
- Buoy A is 1.5 km at a bearing of  $230^\circ$  from buoy B.
- Buoy B is at the right angle of the triangle.

a) Draw a vector diagram showing the relative location of each of the three buoys. Include appropriate distances. Then determine the direction (bearing) from buoy A to buoy B. **(4 marks)**



ANSWER:

- b) Determine the distance, to the nearest 0.1 km, and the direction (bearing), to the nearest degree, from buoy A to buoy C. **(5 marks)**

ANSWER:

- c) A helicopter is hovering at a height of 0.8 km directly above buoy B. Determine the angle of elevation (angle from the horizontal) from buoy C to the helicopter. **(3 marks)**

ANSWER:

**END OF EXAMINATION**

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## FORMULAE

### Geometry:

$$\begin{aligned}\text{Triangle: Area} &= \frac{1}{2}bh \\ &= \frac{1}{2}ab \sin C \\ &= \sqrt{s(s-a)(s-b)(s-c)} \\ \text{where } s &= \frac{a+b+c}{2}\end{aligned}$$

$$\text{Trapezoid: } A = \frac{1}{2}(b_1 + b_2) \cdot h$$

$$\text{Circle: } A = \pi r^2, C = 2\pi r = \pi d$$

$$\text{Sphere: } A = 4\pi r^2, V = \frac{4}{3}\pi r^3$$

$$\text{Cylinder: } A = 2\pi r^2 + 2\pi rh, V = \pi r^2 h$$

$$\text{Cone: } A = \pi rs + \pi r^2, V = \frac{1}{3}\pi r^2 h$$

$$\text{Volume of pyramid: } V = \frac{1}{3}A_b h$$

$$\text{Volume of prism: } V = A_b h$$

### Interest:

$$A = P\left(1 + \frac{r}{n}\right)^{nt}$$

$$I = Prt$$

### Miscellaneous:

$$a^2 = b^2 + c^2 - 2bc \cos A$$

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

$$S_\infty = \frac{a}{1-r}$$

### Probability and Statistics:

$$\mu = \frac{1}{n} \sum (f_i)(x_i)$$

$$\sigma = \sqrt{\frac{1}{n} \sum (x_i - \mu)^2} = \sqrt{\frac{1}{n} \sum x_i^2 - \mu^2}$$

$$\mu = np$$

$$\sigma = \sqrt{np(1-p)}$$

$$z = \frac{x - \mu}{\sigma}$$

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

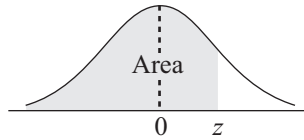
**Note:** Graphing calculators will contain many of these formulae as pre-programmed functions.

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# THE STANDARD NORMAL DISTRIBUTION TABLE



$$F_z(z) = P[Z \leq z]$$

$z$	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
-3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
-3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
-3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
-3.1	0.0010	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0007	0.0007
-3.0	0.0013	0.0013	0.0013	0.0012	0.0012	0.0011	0.0011	0.0011	0.0010	0.0010
-2.9	0.0019	0.0018	0.0017	0.0017	0.0016	0.0016	0.0015	0.0015	0.0014	0.0014
-2.8	0.0026	0.0025	0.0024	0.0023	0.0023	0.0022	0.0021	0.0021	0.0020	0.0019
-2.7	0.0035	0.0034	0.0033	0.0032	0.0031	0.0030	0.0029	0.0028	0.0027	0.0026
-2.6	0.0047	0.0045	0.0044	0.0043	0.0041	0.0040	0.0039	0.0038	0.0037	0.0036
-2.5	0.0062	0.0060	0.0059	0.0057	0.0055	0.0054	0.0052	0.0051	0.0049	0.0048
-2.4	0.0082	0.0080	0.0078	0.0075	0.0073	0.0071	0.0069	0.0068	0.0066	0.0064
-2.3	0.0107	0.0104	0.0102	0.0099	0.0096	0.0094	0.0091	0.0089	0.0087	0.0084
-2.2	0.0139	0.0136	0.0132	0.0129	0.0125	0.0122	0.0119	0.0116	0.0113	0.0110
-2.1	0.0179	0.0174	0.0170	0.0166	0.0162	0.0158	0.0154	0.0150	0.0146	0.0143
-2.0	0.0228	0.0222	0.0217	0.0212	0.0207	0.0202	0.0197	0.0192	0.0188	0.0183
-1.9	0.0287	0.0281	0.0274	0.0268	0.0262	0.0256	0.0250	0.0244	0.0239	0.0233
-1.8	0.0359	0.0352	0.0344	0.0336	0.0329	0.0322	0.0314	0.0307	0.0301	0.0294
-1.7	0.0446	0.0436	0.0427	0.0418	0.0409	0.0401	0.0392	0.0384	0.0375	0.0367
-1.6	0.0548	0.0537	0.0526	0.0516	0.0505	0.0495	0.0485	0.0475	0.0465	0.0455
-1.5	0.0668	0.0655	0.0643	0.0630	0.0618	0.0606	0.0594	0.0582	0.0571	0.0559
-1.4	0.0808	0.0793	0.0778	0.0764	0.0749	0.0735	0.0722	0.0708	0.0694	0.0681
-1.3	0.0968	0.0951	0.0934	0.0918	0.0901	0.0885	0.0869	0.0853	0.0838	0.0823
-1.2	0.1151	0.1131	0.1112	0.1093	0.1075	0.1056	0.1038	0.1020	0.1003	0.0985
-1.1	0.1357	0.1335	0.1314	0.1292	0.1271	0.1251	0.1230	0.1210	0.1190	0.1170
-1.0	0.1587	0.1562	0.1539	0.1515	0.1492	0.1469	0.1446	0.1423	0.1401	0.1379
-0.9	0.1841	0.1814	0.1788	0.1762	0.1736	0.1711	0.1685	0.1660	0.1635	0.1611
-0.8	0.2119	0.2090	0.2061	0.2033	0.2005	0.1977	0.1949	0.1922	0.1894	0.1867
-0.7	0.2420	0.2389	0.2358	0.2327	0.2296	0.2266	0.2236	0.2206	0.2177	0.2148
-0.6	0.2743	0.2709	0.2676	0.2643	0.2611	0.2578	0.2546	0.2514	0.2483	0.2451
-0.5	0.3085	0.3050	0.3015	0.2981	0.2946	0.2912	0.2877	0.2843	0.2810	0.2776
-0.4	0.3446	0.3409	0.3372	0.3336	0.3300	0.3264	0.3228	0.3192	0.3156	0.3121
-0.3	0.3821	0.3783	0.3745	0.3707	0.3669	0.3632	0.3594	0.3557	0.3520	0.3483
-0.2	0.4207	0.4168	0.4129	0.4090	0.4052	0.4013	0.3974	0.3936	0.3897	0.3859
-0.1	0.4602	0.4562	0.4522	0.4483	0.4443	0.4404	0.4364	0.4325	0.4286	0.4247
-0.0	0.5000	0.4960	0.4920	0.4880	0.4840	0.4801	0.4761	0.4721	0.4681	0.4641

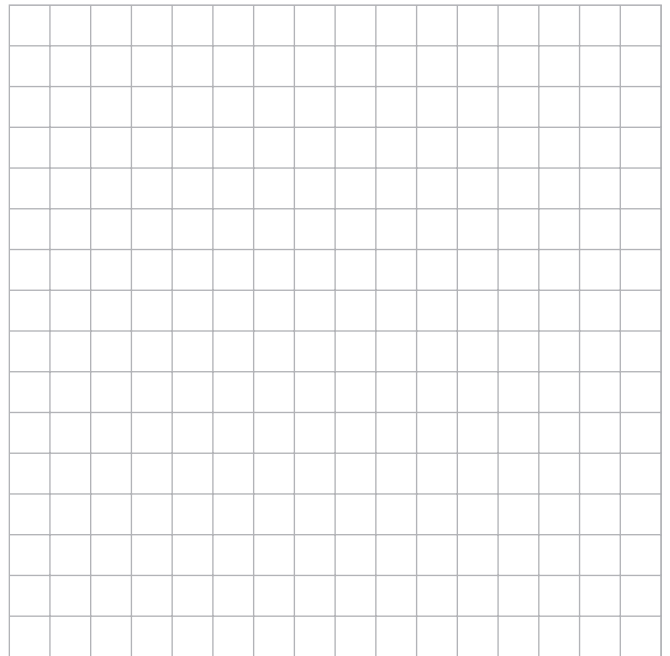
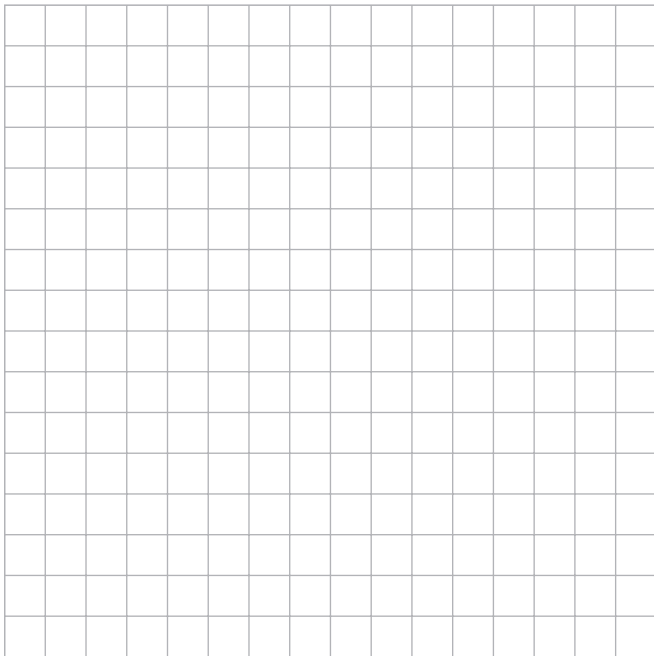
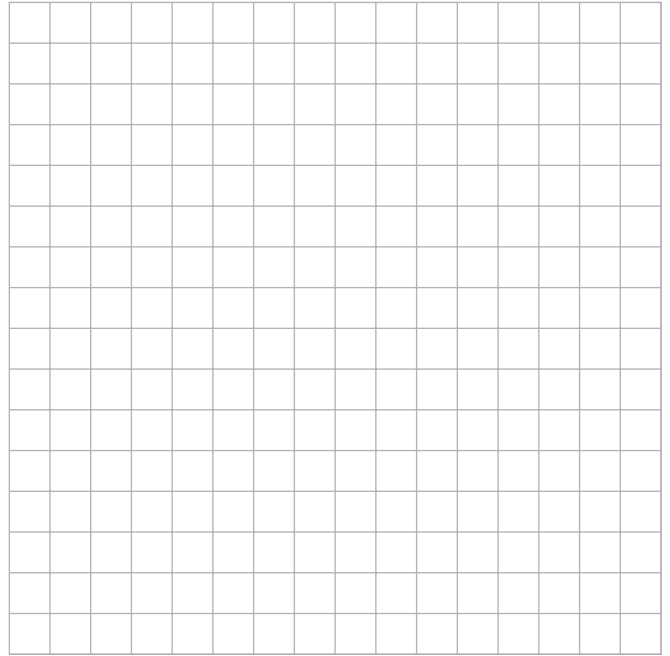
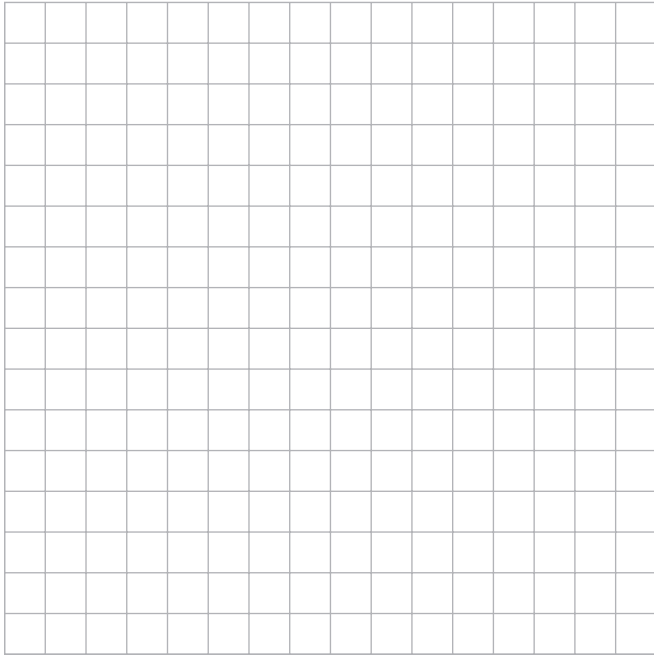
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$$F_z(z) = P[Z \leq z]$$

$z$	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.08</b>	<b>0.09</b>
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9278	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

# ROUGH WORK FOR GRAPHING

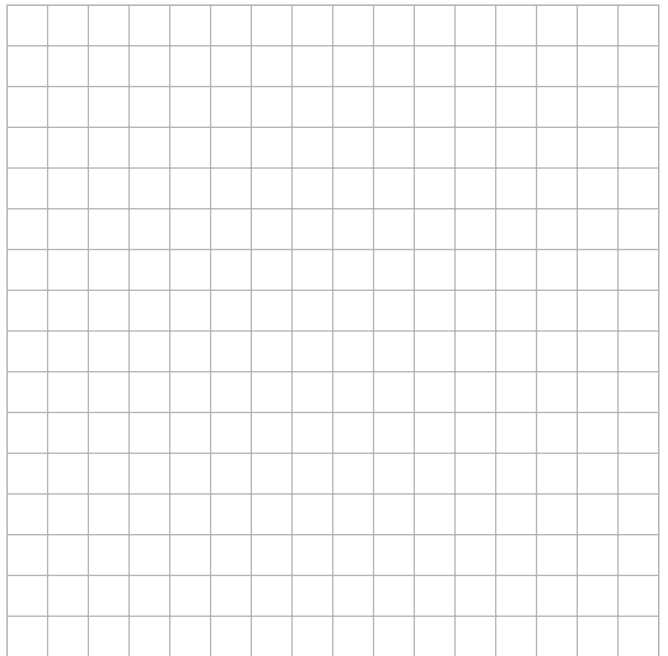
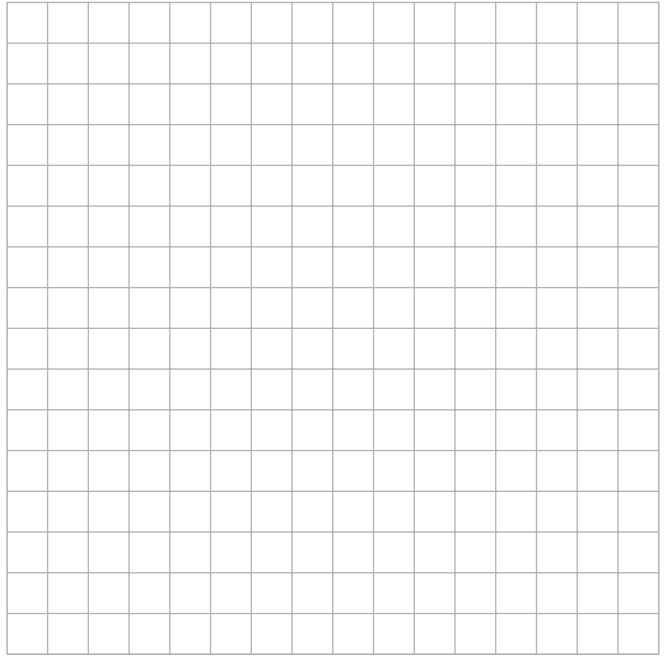
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# ROUGH WORK FOR GRAPHING

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## **ROUGH WORK FOR MULTIPLE-CHOICE**