

Insert Personal Education Number (PEN) here.

Insert **only** pre-printed PEN label here.

### STUDENT INSTRUCTIONS

1. Insert 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.

# APPLICATIONS OF MATHEMATICS 12

**JUNE 2000**

COURSE CODE = AMA

Insert **only** hand-printed PEN here.

Ministry use only.

Question 1:  
1.  .   
(2)

Question 6a:  
9.  .   
(1)

Question 2:  
2.  .   
(3)

Question 6b:  
10.  .   
(2)

Question 3:  
3.  .   
(3)

Question 6c:  
11.  .   
(1)

Question 4a:  
4.  .   
(1)

Question 7a:  
12.  .   
(1)

Question 4b:  
5.  .   
(1)

Question 7b:  
13.  .   
(1)

Question 4c:  
6.  .   
(1)

Question 7c:  
14.  .   
(2)

Question 5a:  
7.  .   
(2)

Question 8a:  
15.  .   
(2)

Question 5b:  
8.  .   
(1)

Question 8b:  
16.  .   
(1)

# **APPLICATIONS OF MATHEMATICS 12**

**JUNE 2000**

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>two</b> parts: |               |                    |
| PART A: 45 multiple-choice questions              | 45            | 75                 |
| PART B: 8 written-response questions              | 25            | 45                 |
|   | <b>Total:</b> | <b>70 marks</b>    |
|   |               | <b>120 minutes</b> |
2. The last **three** pages inside the back cover contain **Formulae, Table of Z-scores, 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 as well as for graphing functions. Computers, calculators with a QWERTY keyboard, and electronic writing pads will not be allowed. Students must not bring any external devices to support calculators such as manuals, printed or electronic cards, printers, memory expansion chips or cards, or external keyboards. Students may have more than one calculator available during the examination, of which one may be a scientific calculator. 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.
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: 45 marks**

**Suggested Time: 75 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. If matrices  $P_{2 \times 5}$  and  $Q_{5 \times 3}$  are multiplied, what is the dimension of the product matrix  $PQ$  ?

- A.  $2 \times 3$
- B.  $2 \times 5$
- C.  $3 \times 2$
- D.  $3 \times 5$

2. Determine  $2M^2$  if  $M = \begin{bmatrix} 1 & -2 \\ 2 & -1 \end{bmatrix}$ .

A.  $\begin{bmatrix} -12 & 0 \\ 0 & -12 \end{bmatrix}$

B.  $\begin{bmatrix} -6 & 0 \\ 0 & -6 \end{bmatrix}$

C.  $\begin{bmatrix} 2 & 8 \\ 8 & 2 \end{bmatrix}$

D.  $\begin{bmatrix} 4 & 16 \\ 16 & 4 \end{bmatrix}$

3. Determine the value of  $x$  if:  $\begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 4 \\ 6 \end{bmatrix}$

- A. 0
- B. 1
- C. 2
- D. 3

4. Which of the following **cannot** be a transition matrix for a long-term trend problem?

A. 
$$\begin{array}{c} \text{To} \\ \text{From} \end{array} \begin{bmatrix} .3 & .6 \\ .7 & .4 \end{bmatrix}$$

B. 
$$\begin{array}{c} \text{To} \\ \text{From} \end{array} \begin{bmatrix} .2 & .8 \\ .1 & .9 \end{bmatrix}$$

C. 
$$\begin{array}{c} \text{To} \\ \text{From} \end{array} \begin{bmatrix} \frac{3}{4} & \frac{1}{4} \\ \frac{5}{8} & \frac{3}{8} \end{bmatrix}$$

D. 
$$\begin{array}{c} \text{To} \\ \text{From} \end{array} \begin{bmatrix} \frac{1}{6} & \frac{5}{6} \\ \frac{5}{6} & \frac{1}{6} \end{bmatrix}$$

5. Determine the entry in the 2<sup>nd</sup> row and 1<sup>st</sup> column of  $AB$  if  $A = \begin{bmatrix} a & c \\ b & d \end{bmatrix}$  and  $B = \begin{bmatrix} e & f \\ g & h \end{bmatrix}$ .

- A.  $af + ch$
- B.  $ag + bh$
- C.  $be + dg$
- D.  $ce + df$

6. For the  $2 \times 2$  matrices  $M$  and  $N$ ,  $M + N = \begin{bmatrix} 3 & 4 \\ 1 & -1 \end{bmatrix}$  and  $M - N = \begin{bmatrix} 3 & -12 \\ -5 & 5 \end{bmatrix}$ . Determine the matrix  $M$ .

A. 
$$\begin{bmatrix} -6 & 8 \\ 2 & -4 \end{bmatrix}$$

B. 
$$\begin{bmatrix} -3 & 4 \\ 1 & -2 \end{bmatrix}$$

C. 
$$\begin{bmatrix} 3 & -4 \\ -2 & 2 \end{bmatrix}$$

D. 
$$\begin{bmatrix} 6 & -8 \\ -2 & 4 \end{bmatrix}$$



7. The number of sales a supplier made of 3 items on 3 consecutive days is summarized in the table below.

	Item 1	Item 2	Item 3	Total Sales
Day 1	4	3	2	\$12.70
Day 2	2	4	3	\$13.30
Day 3	1	2	4	\$10.65

Determine the cost of item 2.

- A. \$1.25
  - B. \$1.45
  - C. \$1.50
  - D. \$1.60
8. Given the spreadsheet with formulas as shown below, what value would be calculated for cell C4?

	A	B	C
1			
2	48	24	12
3	36	60	4
4			=A2+B2/C2
5			
6			

- A. 6
  - B. 16
  - C. 50
  - D. 51
9. An orchardist buys a tractor for \$48 000. If the tractor depreciates at a rate of 8% per year, how much would it be worth after four years?
- A. \$32 640.00
  - B. \$34 386.86
  - C. \$37 377.02
  - D. \$65 303.47

Use the following information to answer questions 10 and 11.

Annual rate: 0.0725  
 Term (years): 5  
 Pmts/year: 12  
 Start date: 1/1/99  
 # of pmts: 60  
 Payment/mo: \$600  
 Total pmts: \$36 000

A	B	C	D	E	F	G	H	I
Pmt #	Date	Bal. Before Payment \$	Interest Payment \$	Payment to Princ. \$	Ending Balance \$	Cumulative Interest \$	Year End Int. Paid \$	Year End Princ. Paid \$
1	1/1/99	60000.00	362.50	237.50	59762.50	362.50		
2	1/2/99	59762.50	361.07	238.93	59523.57	723.57		
3	1/3/99	59523.57	359.62	240.38	59283.19	1083.19		
4	1/4/99	59283.19	358.17	241.83	59041.36	1441.36		
5	1/5/99	59041.36	356.71	243.29	58798.07	1798.07		
6	1/6/99	58798.07	355.24	244.76	58553.31	2153.31		
7	1/7/99	58553.31	353.76	246.24	58307.07	2507.07		
8	1/8/99	58307.07	352.27	247.73	58059.34	2859.34		
9	1/9/99	58059.34	350.78	249.22	57810.12	3210.12		
10	1/10/99	57810.12	349.27	250.73	57559.39	3559.39		
11	1/11/99	57559.39	347.75	252.25	57307.14	3907.14		
12	1/12/99	57307.14	346.23	253.77	57053.37	4253.37	4253.37	2946.63

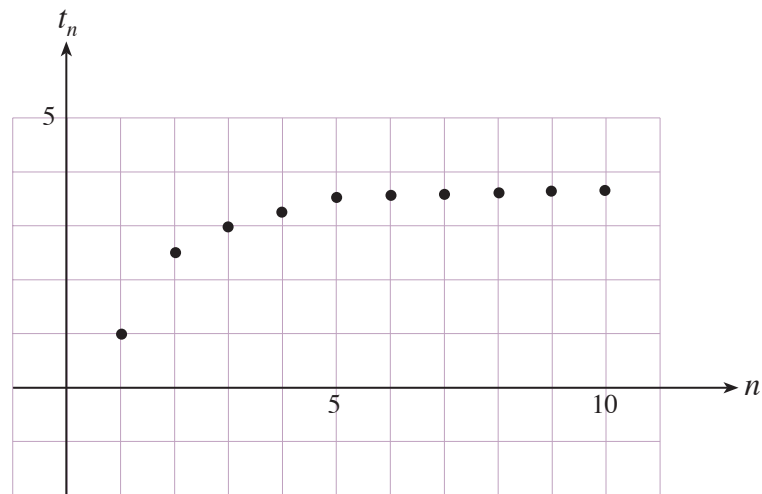
10. The spreadsheet above shows part of a payment schedule for the amortization of a \$60 000 mortgage loan. If the monthly payment is increased to \$700, which of the outcomes below would be true?

- A. Year end interest paid will **decrease** and year end principal paid will **decrease**.
- B. Year end interest paid will **decrease** and year end principal paid will **increase**.
- C. Year end interest paid will **increase** and year end principal paid will **decrease**.
- D. Year end interest paid will **increase** and year end principal paid will **increase**.

11. In the spreadsheet above, what percent of the first year's payment goes towards the principal?

- A. 39.6%
- B. 40.9%
- C. 42.3%
- D. 59.1%

12. If a person borrows \$100 000 at an annual interest rate of 8.5% compounded monthly, what amount of interest will be charged for the first month?
- A. \$708.33  
 B. \$736.59  
 C. \$850.00  
 D. \$868.33
13. At the beginning of the month, a student buys a graphing calculator for \$150. He pays \$50 down, \$50 at the end of the month, and the remaining amount at the end of the following month. How much is the last payment if the credit charge is calculated at an annual rate of 15% compounded monthly?
- A. \$50.94  
 B. \$51.89  
 C. \$52.70  
 D. \$57.74
14. Which term best describes the sequence shown in the graph below?



- A. static  
 B. divergent  
 C. alternating  
 D. convergent

15. A set of cylindrical storage containers, decreasing in capacity, is constructed as follows.
- The largest container has a height of 40 cm and a diameter of 40 cm.
  - The next size container is half the height and half the diameter of the first.
  - Each of the others is half the height and half the diameter of the container that is one size larger.

Determine an expression for the volume of the  $n^{\text{th}}$  container.

- A.  $(16\,000\pi)\left(\frac{1}{2}\right)^{n-1}$
- B.  $(16\,000\pi)\left(\frac{1}{4}\right)^{n-1}$
- C.  $(16\,000\pi)\left(\frac{1}{8}\right)^{n-1}$
- D.  $(16\,000\pi)\left(\frac{1}{16}\right)^{n-1}$

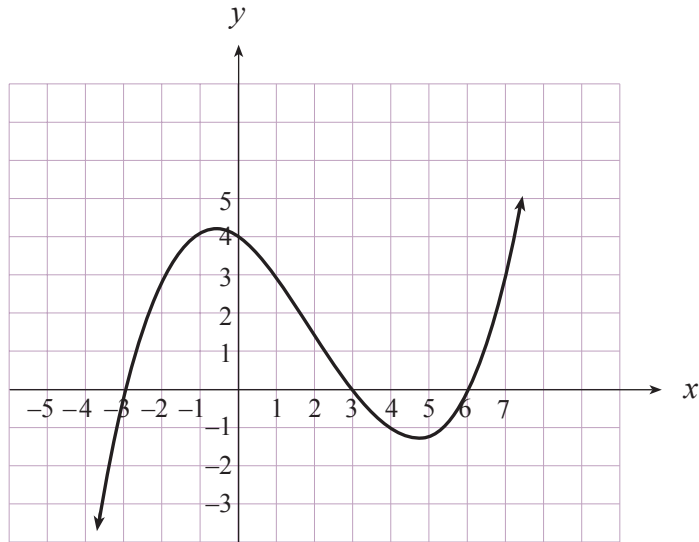
16. An optimal solution to a linear programming problem with a finite solution always occurs at which of the following points of the feasible region?

- A. the origin
- B. a corner point
- C. the  $x$ -intercept
- D. the  $y$ -intercept

17. The cost to rent a photocopier for 60 months is \$100 per month plus 5¢ per copy. The same photocopier can be purchased for \$2 000 plus 7¢ per copy. Determine the number of copies for which the 5 year cost is the same for renting as it is for purchasing.

- A. 2 000
- B. 20 000
- C. 160 000
- D. 200 000

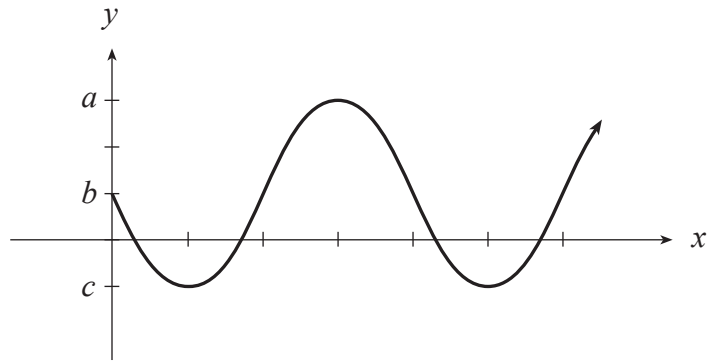
18. For the graph  $y = f(x)$  shown below, determine  $f(0)$ .



- A. 0  
B. 4  
C. -3, 3, 6  
D. -3, 3, 4, 6
19. The temperature,  $T$ , of an object that is cooling is given by  $T = T_s + 80(0.30)^{0.2t}$  where  $T_s$  = temperature of surroundings, and  $t$  = time in minutes. How long will it take the object to cool down to  $40^\circ$ , if  $T_s = 20^\circ$  ?
- A. 3.81 minutes  
B. 5.32 minutes  
C. 5.76 minutes  
D. 5.81 minutes

20. Two cars leave an intersection at the same time. Car A travels north at an average speed of 45 km/h. Car B travels east at an average speed of 30 km/h. Which expression gives the distance,  $D$ , in km, between the two cars as a function of time,  $t$ , in hours?
- A.  $D(t) = 75t$
  - B.  $D(t) = 87t$
  - C.  $D(t) = \sqrt{1125} \cdot t$
  - D.  $D(t) = \sqrt{2925} \cdot t$
21. Determine the period of the function  $y = 2 \cos(2\pi x)$ .
- A. 1
  - B. 2
  - C.  $\pi$
  - D.  $2\pi$
22. The height,  $h$ , in metres, of a certain Ferris wheel seat above the ground at time,  $t$ , in seconds, after the ride is started is given by the formula  $h(t) = 20 \sin\left(\frac{\pi}{20}t\right) + 21$ . Determine the height of the seat 60 seconds after the ride has started.
- A. 21.0 m
  - B. 24.1 m
  - C. 30.4 m
  - D. 41.0 m

23. What is the amplitude of the sinusoidal function graphed below?

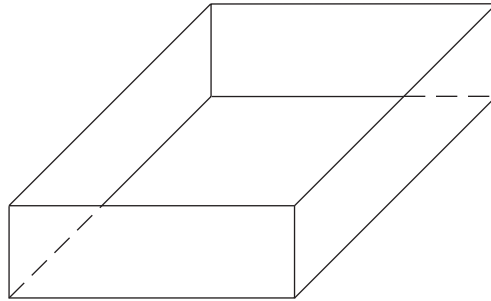


- A.  $a$
- B.  $b$
- C.  $a + b$
- D.  $a - b$

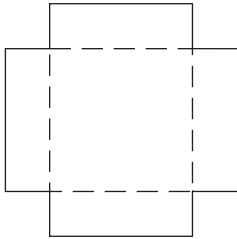
24. A lumber company finds its monthly profits,  $P$ , in dollars, can be approximated by the periodic function  $P(t) = 40\,000\left[1 - \cos\left(\frac{\pi}{6}t\right)\right]$ , where  $t$  is the number of months since January 1, 1998. What is the first month in the year 2000 where company profits exceed \$50 000?

- A. March
- B. April
- C. July
- D. August

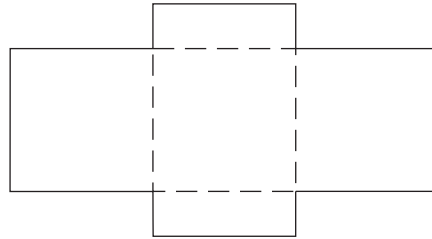
25. Which of the following nets will produce the square-based, **open-top** box illustrated below?



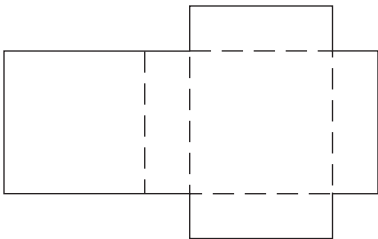
A.



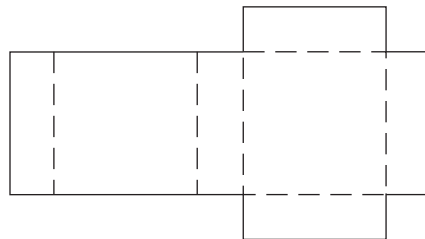
B.



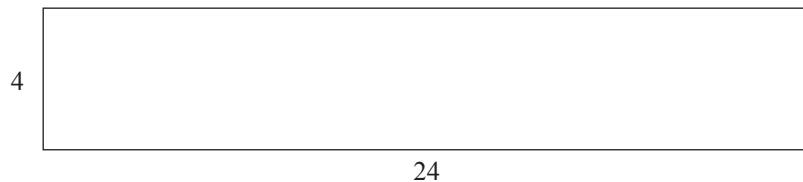
C.



D.



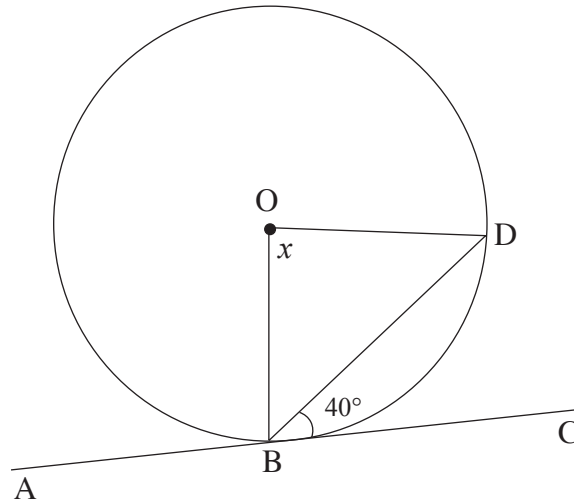
26. A rectangular counter top is to be tiled with the triangular tiles shown below. Determine the minimum number of triangular tiles required to completely tile the rectangle.



- A. 6
- B. 8
- C. 12
- D. 16

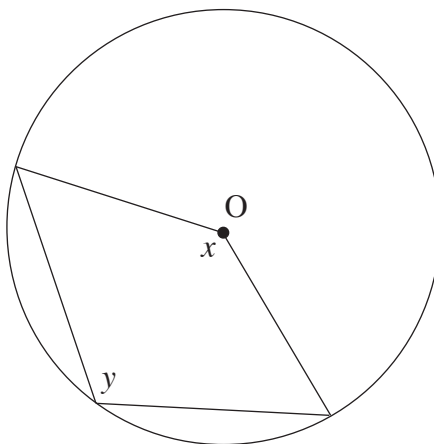


27. Given that  $O$  is the centre of the circle and  $AC$  is tangent to the circle at  $B$ , determine the value of  $x$ .



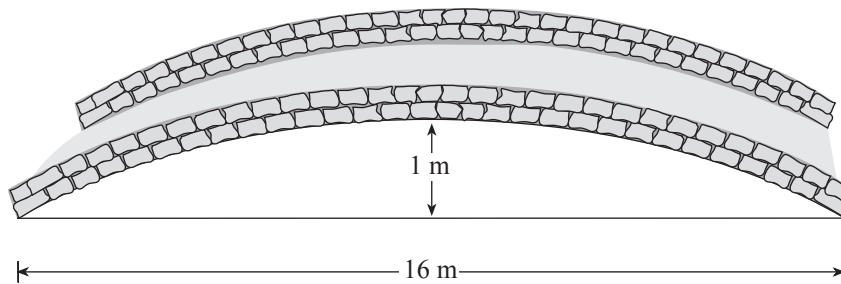
- A.  $50^\circ$
- B.  $80^\circ$
- C.  $90^\circ$
- D.  $100^\circ$

Use the following diagram to answer question 28.



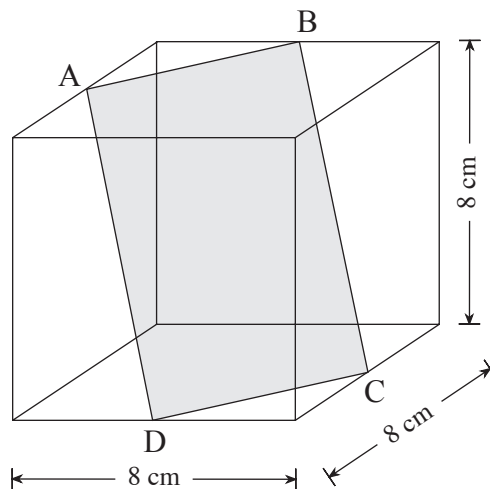
28. Given the circle with centre  $O$ , which of the following best describes the relationship between  $x$  and  $y$ ?
- A.  $x = y$
  - B.  $x + y = 180^\circ$
  - C.  $x + y = 360^\circ$
  - D.  $x + 2y = 360^\circ$

29. A bridge is built across a ravine in a large garden. The horizontal span of the bridge is 16 m with a circular arc 1 m above the horizontal centre, as shown in the diagram. Determine the radius of the circular arc.



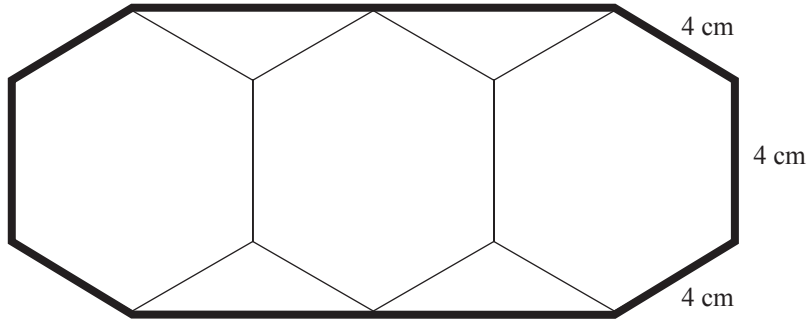
- A. 31 m
- B. 31.5 m
- C. 32 m
- D. 32.5 m

30. A rectangular sheet of tinted glass is placed in a cubical box with sides of 8 cm. The glass fits in the box so that the corners sit on the midpoints A, B, C and D of the sides, as shown in the diagram. Determine the length of side AD. (Accurate to the nearest 0.01 cm.)



- A. 8.00
- B. 8.94
- C. 9.80
- D. 11.31

31. The diagram below shows three identical hexagonal glasses held together by a plastic strap. If the length of each side of the glasses is 4 cm, what is the length of the plastic strap?



- A. 37.86 cm  
B. 40 cm  
C. 48 cm  
D. 51.71 cm
32. Which of the following are examples of continuous data?
- i) the number of grams of fat in a chocolate bar
  - ii) the number of people who eat chocolate bars
  - iii) the number of square cm of paper required to wrap a chocolate bar
- A. i and ii  
B. i and iii  
C. ii and iii  
D. all are continuous data
33. To calculate **one** summary point for a median-median line of best fit, the following points were used:  $(3, 8)$ ,  $(4, 7)$ ,  $(6, 14)$ ,  $(7, 11)$ ,  $(15, 15)$ . What are the coordinates of the summary point?
- A.  $(6, 11)$   
B.  $(6, 14)$   
C.  $(7, 11)$   
D.  $(7, 14)$

Use the following information to answer questions 34 and 35.

A certain airline company flies a route from Vancouver to Penticton. The relationship between the number of passengers,  $n$ , and the profit/loss in dollars,  $P$ , is shown in the chart below.

$n$	$P$
62	1 700
40	210
20	-650

34. Determine the linear correlation coefficient for the data above.
- A. .97
  - B. .98
  - C. .99
  - D. 1.00
35. By using the least squares line of best fit, determine the minimum number of passengers needed by the airline to avoid a loss.
- A. 32
  - B. 33
  - C. 34
  - D. 35
36. Which of the following could **not** be the probability of an event happening?
- A. -1
  - B. 0
  - C. .5
  - D. 1

37. The results of a high jump competition showed a mean best height of 238 cm with a standard deviation of 2.4 cm. Determine the  $z$ -score for a jumper whose best height was 245 cm.
- A.  $-2.92$
  - B.  $-1.46$
  - C.  $1.46$
  - D.  $2.92$
38. A carwash loses \$50 on rainy days and gains \$240 on days it does not rain. If the probability of rain is 0.15, what is the expected profit each day of operation?
- A. \$145.00
  - B. \$190.00
  - C. \$196.50
  - D. \$211.50
39. There are three paths joining opposite ends of a park (none of which cross). If a girl at one end and a boy at the other end choose random paths, what is the probability that they will meet on the way through the park?
- A.  $\frac{1}{9}$
  - B.  $\frac{1}{6}$
  - C.  $\frac{1}{3}$
  - D.  $\frac{2}{3}$

40. A recipe calls for four ingredients: baking powder, flour, milk and sugar. There are no directions as to the order in which the ingredients are to be added to the mixing bowl. If the ingredients are randomly added to the bowl, what is the probability that flour (F) and milk (M) are added in sequence (either FM or MF)?

- A.  $\frac{1}{6}$
- B.  $\frac{1}{4}$
- C.  $\frac{1}{3}$
- D.  $\frac{1}{2}$

41. According to a research company survey, 70% of telephone subscribers have an answering machine. If a telemarketing campaign contacts 200 telephone subscribers, what is the probability that 150 or more will have an answering machine?

- A. 4%
- B. 5%
- C. 6%
- D. 7%

42. The table below shows variations in the cougar population in a provincial park.

<b>Year</b> ( $x$ )	0	3	5	6	8	9
<b>Cougar population</b> ( $y$ )	266	399	266	183	133	185

The population varies sinusoidally with a period of 10 years. The number of cougars is never higher than 406 and never lower than 126. Which equation below best models this data?

- A.  $y = 10 \sin(0.2x) + 126$
- B.  $y = 140 \sin(0.63x) + 266$
- C.  $y = 126 \sin(0.63x) + 406$
- D.  $y = 140 \sin(10x) + 266$

43. Three regular dice with the numbers 1, 2, 3, 4, 5, 6 on each of them are thrown. What is the probability of obtaining a sum of 15?

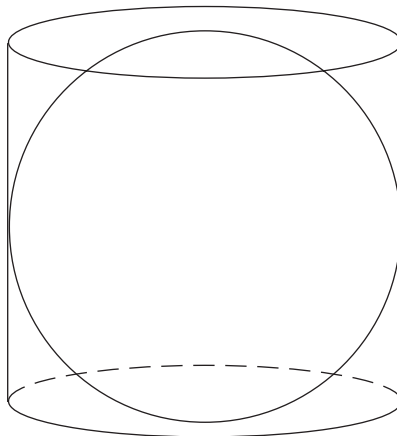
A.  $\frac{1}{24}$

B.  $\frac{1}{36}$

C.  $\frac{1}{72}$

D.  $\frac{5}{108}$

44. A sphere is tightly packed in a cylindrical container as shown in the diagram below. What is the ratio of the volume of air in the container to the volume of the sphere?



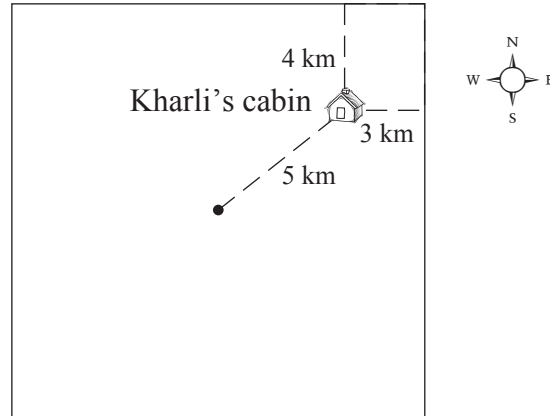
A. 1 : 2

B. 2 : 1

C. 2 : 3

D. 3 : 2

45. Kharli's cabin on Square Island is 3 km from East Beach, 4 km from North Beach and 5 km from the centre of the island. What is the area of Square Island?



- A.  $196 \text{ km}^2$
- B.  $256 \text{ km}^2$
- C.  $324 \text{ km}^2$
- D.  $400 \text{ km}^2$

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



## PART B: WRITTEN RESPONSE

Value: 25 marks

Suggested Time: 45 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. During an NHL hockey season, information comparing games played,  $P$ , to number of goals,  $G$ , was collected. The data for a player is shown in the table below.

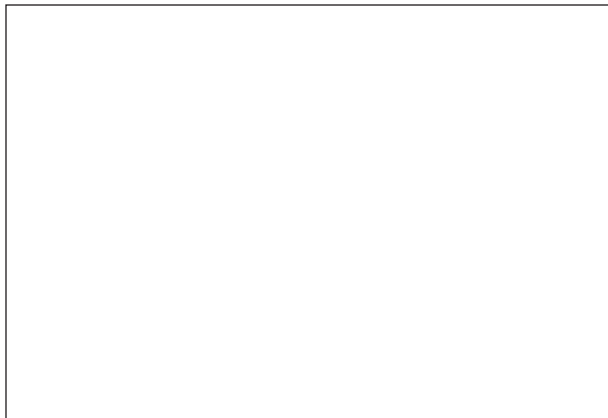
<b>Games played (<math>P</math>)</b>	10	20	40
<b>Number of goals (<math>G</math>)</b>	13	25	37

Determine the least squares linear regression equation and predict the number of goals this player will score in the full 82-game season. **(2 marks)**

ANSWER:

2. The population of a certain country is 12 million and growing at a rate of 2.5% annually. Assuming that it is growing continuously, the population,  $P$  (in millions),  $t$  years from now is determined by the formula  $P = 12e^{0.025t}$ . Determine how long it will take the population to reach 20 million. **(3 marks)**

If providing a graphical solution, state the function(s) used, sketch the graph, indicate appropriate window dimensions and clearly explain how your solution is derived from the graph.



$$Y_1 =$$

$$Y_2 =$$

$$Y_3 =$$

$$Y_4 =$$

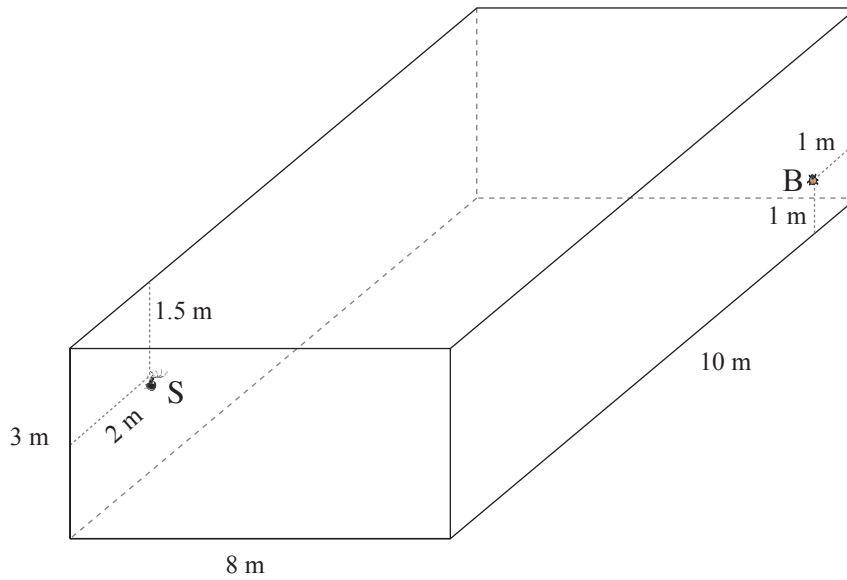
[            ,            ]            [            ,            ]

$x$   
min       $x$   
max

$y$   
min       $y$   
max

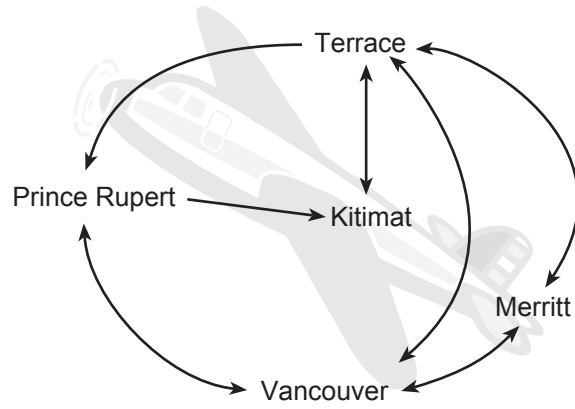
ANSWER:

3. In the diagram below, a spider, S, is located on the wall 1.5 m from the ceiling and 2 m from the corner. The spider is heading to a spot on the opposite wall to eat a bug, B, located 1 m from the floor and 1 m from the corner. If the dimensions of the room are 8 m  $\times$  10 m  $\times$  3 m, determine the shortest distance the spider has to crawl to get to the bug. **(3 marks)**



ANSWER:

4. An airline has flights between five cities as shown in the diagram below.



a) Complete the flight matrix to summarize the data.

**(1 mark)**

$$F = \begin{matrix} & & & & & \mathbf{To} \\ & & & & & \mathbf{V} & \mathbf{P} & \mathbf{T} & \mathbf{K} & \mathbf{M} \\ \mathbf{From} & \mathbf{V} & & & & & & & & \\ & \mathbf{P} & & & & & & & & \\ & \mathbf{T} & & & & & & & & \\ & \mathbf{K} & & & & & & & & \\ & \mathbf{M} & & & & & & & & \end{matrix}$$



b) How many routes are there from Vancouver to Kitimat with exactly one stopover? **(1 mark)**

ANSWER:

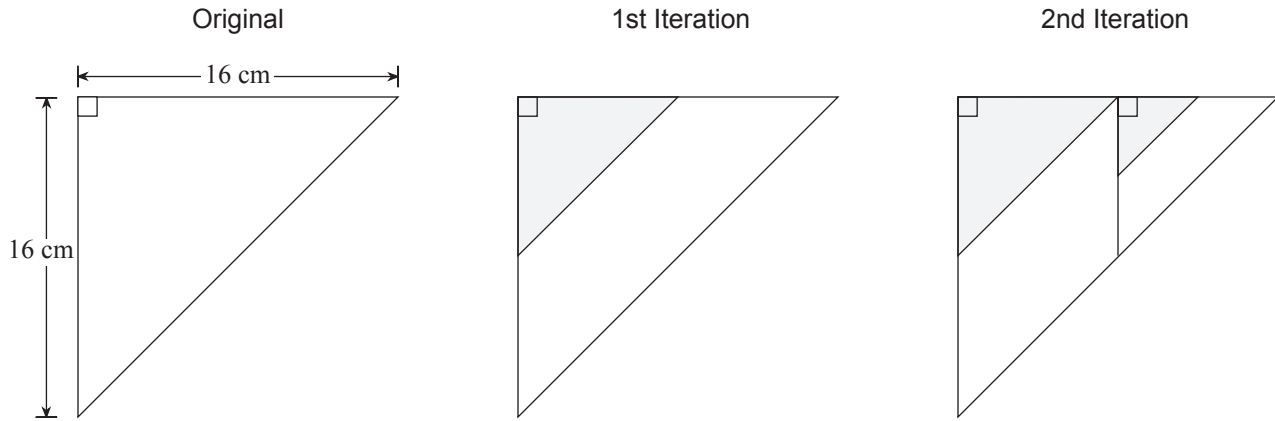
c) How many routes are there from Prince Rupert to Merritt with no more than two stopovers?  
**(1 mark)**

ANSWER:

**OVER**

5. The fractal shown in the diagram below is created as follows:

- A shaded triangle is formed by joining the midpoints of the vertical and horizontal sides.
- A vertical line is drawn from the midpoint of the horizontal side, creating a new isosceles right triangle.
- The process is continued.



a) What is the total **unshaded** area in the 4<sup>th</sup> iteration?

**(2 marks)**

ANSWER:

b) If the process is continued without end, what area of the fractal is unshaded? **(1 mark)**

ANSWER:

**OVER**

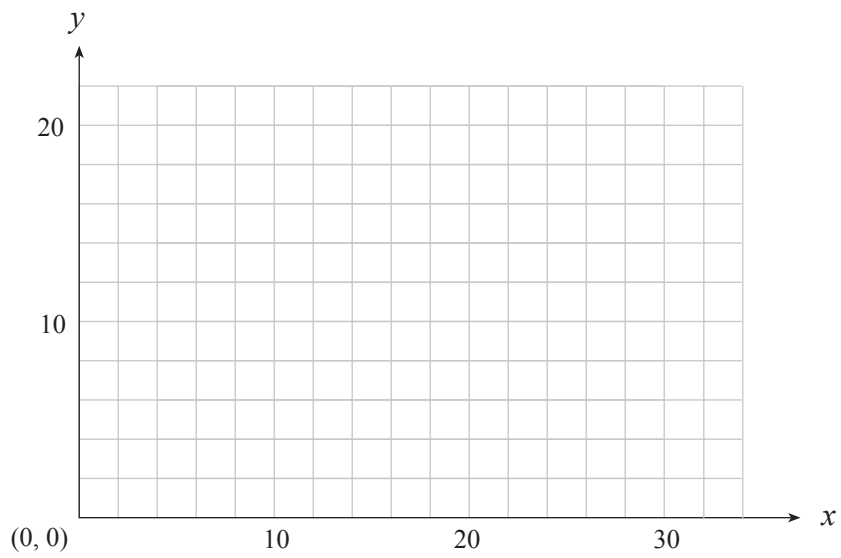
6. A snowboard manufacturer makes a standard model snowboard and a deluxe competition model.

- Each standard snowboard requires 6 hours for fabricating and 1 hour for finishing.
- Each competition snowboard requires 8 hours for fabricating and 3 hours for finishing.
- There is a maximum of 120 hours available per week for fabricating, and 30 hours for finishing.
- The manufacturer makes a \$70 profit on each standard snowboard and \$110 on each competition snowboard.

a) Letting  $x$  represent the number of standard model snowboards produced each week and  $y$  represent the number of competition boards, list the constraints and the objective function needed to determine the maximum weekly profit. **(1 mark)**

ANSWER:

- b) How many of each type of snowboard should be manufactured per week for maximum weekly profit? **(2 marks)**



ANSWER:

- c) Determine the maximum weekly profit. **(1 mark)**

ANSWER:

7. A communications company is researching the length of long distance telephone calls before marketing its new long distance service. The table below summarizes the data gathered for calls under 40 minutes.

Length of calls (minutes)	Number of calls
$0 \leq t < 10$	320
$10 \leq t < 20$	260
$20 \leq t < 30$	250
$30 \leq t < 40$	170
<hr/> <b>Total 1 000</b>	

- a) Determine the mean for the length of telephone calls.

**(1 mark)**

ANSWER:

b) Determine the standard deviation for the length of telephone calls.

**(1 mark)**

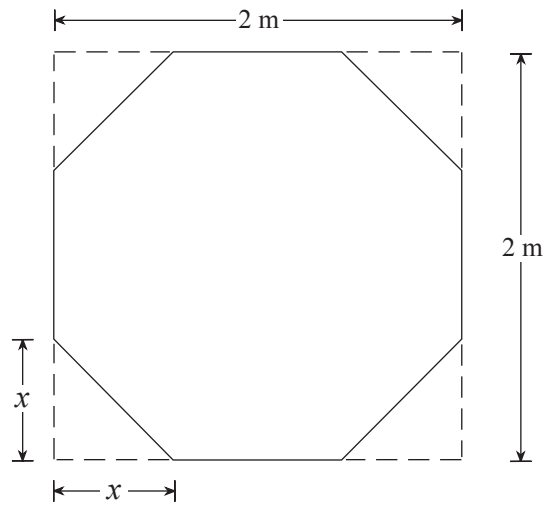
ANSWER:

c) Determine a 90% confidence interval for the mean length of a call under 40 minutes.

**(2 marks)**

ANSWER:

8. For a design project, triangular pieces are cut off the corners of a  $2\text{ m} \times 2\text{ m}$  square sheet of cardboard to form a regular octagon, as shown in the diagram below.



- a) Determine  $x$ , the distance from each corner that the cuts should be made. **(2 marks)**

ANSWER:



b) Determine the area of the resulting octagon.

**(1 mark)**

ANSWER:

**END OF EXAMINATION**

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## FORMULAE

### Geometry:

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

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

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

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

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

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

Volume of prism:  $V = A_b h$

### Interest:

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

$$I = Prt$$

### Miscellaneous:

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

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

$$d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

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

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

### Probability and Statistics:

$${}_n P_r = P(n, r) = \frac{n!}{(n-r)!}$$

$${}_n C_r = C(n, r) = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

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

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

$$\mu = np$$

$$\sigma = \sqrt{npq}$$

$$b(n, r; p) = \binom{n}{r} p^r q^{n-r}$$

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

$$\bar{x} - z_{\alpha/2} \frac{\sigma}{\sqrt{n}} < \mu < \bar{x} + z_{\alpha/2} \frac{\sigma}{\sqrt{n}}$$

$$E(x) = x_1 p_1 + x_2 p_2 + \dots + x_n p_n$$

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

$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\left(\sqrt{n(\sum x^2) - (\sum x)^2}\right) \left(\sqrt{n(\sum y^2) - (\sum y)^2}\right)}$$

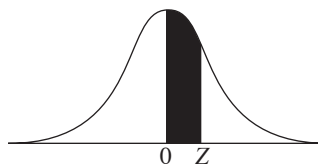
**Note:** Graphing calculators will contain many of these formulae as pre-programmed functions.

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# TABLE OF Z-SCORES

## Z = Z-Score

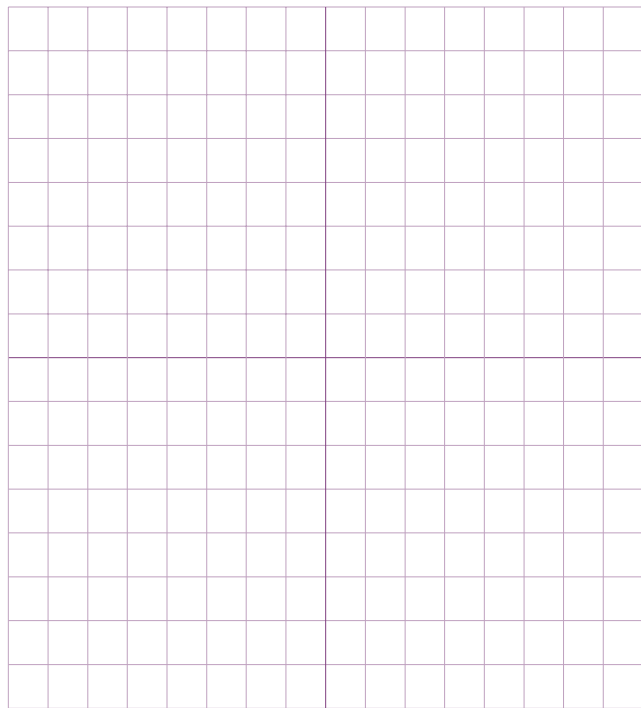
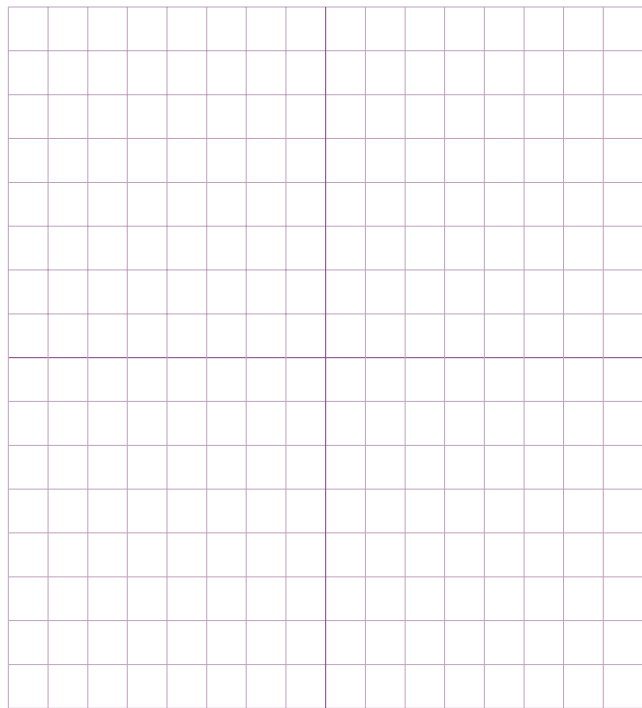
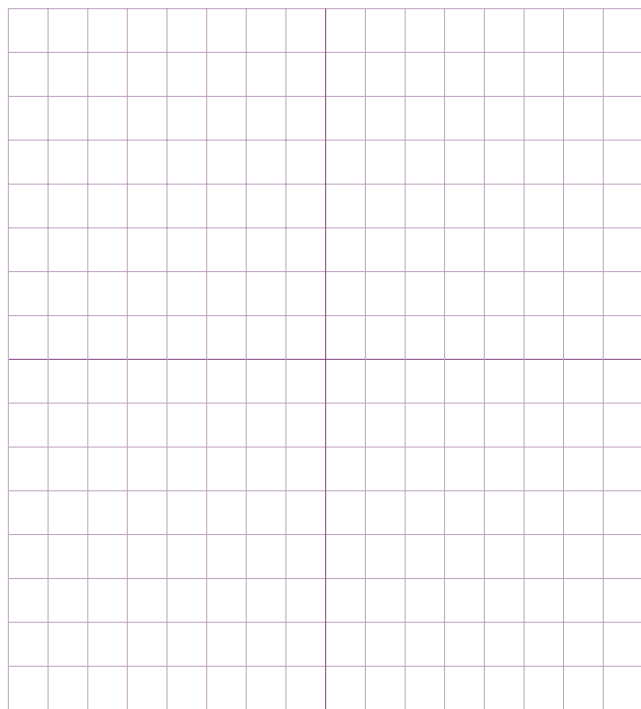
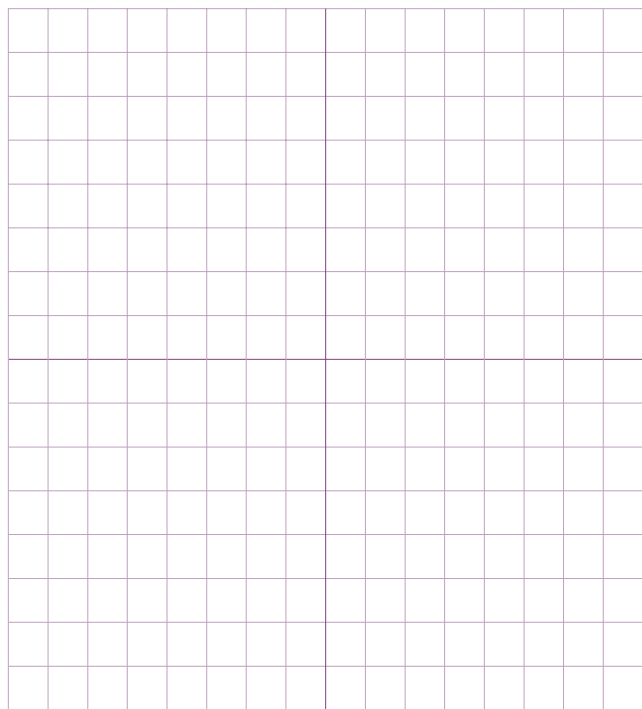
An entry in the table is the area under the curve between  $Z = 0$  and a positive value of  $Z$ . Areas for negative values of  $Z$  are obtained by symmetry.



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	0.1433	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	0.2703	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	0.3642	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

**ROUGH WORK FOR GRAPHING**

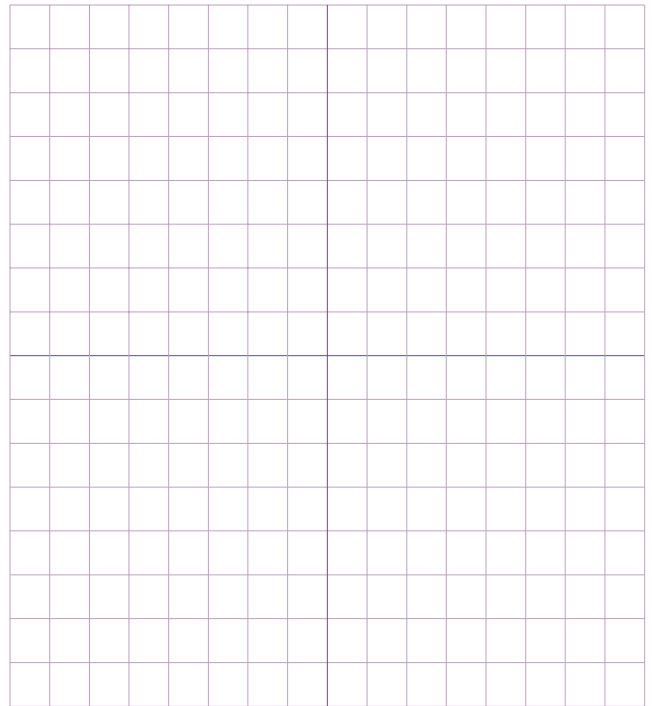
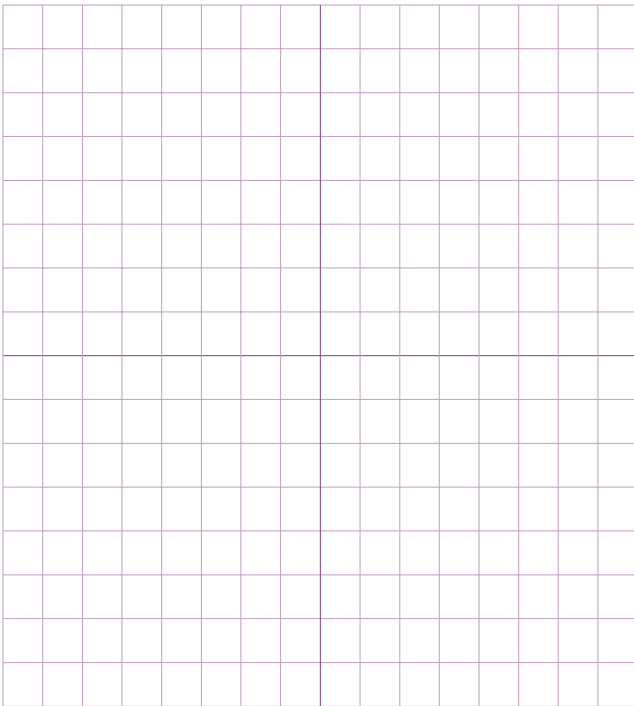
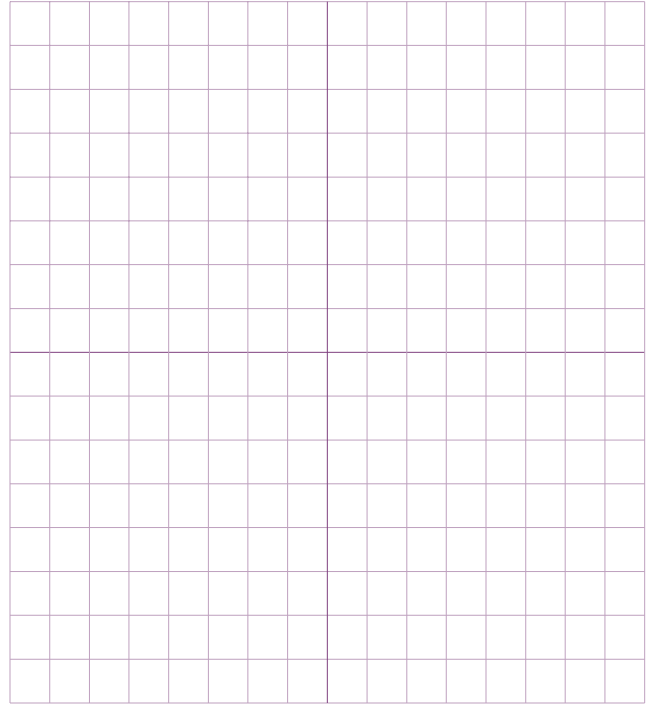
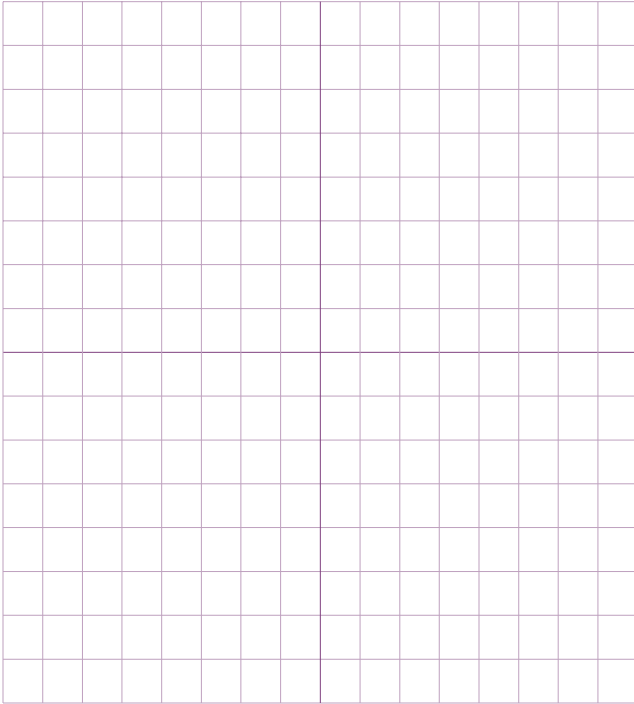
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# ROUGH WORK FOR GRAPHING

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## ROUGH WORK FOR MULTIPLE-CHOICE