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Applications of  
Mathematics 12

JANUARY 2001

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.  .

(1)

Question 7:

9.  .

(2)

Question 1b:

2.  .

(2)

Question 8a:

10.  .

(3)

Question 2a:

3.  .

(2)

Question 8b:

11.  .

(1)

Question 2b:

4.  .

(1)

Question 3:

5.  .

(3)

Question 4:

6.  .

(3)

Question 5:

7.  .

(3)

Question 6:

8.  .

(4)

# **APPLICATIONS OF MATHEMATICS 12**

**JANUARY 2001**

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, 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, 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.
- 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: 45 marks**

**Suggested Time: 75 minutes**

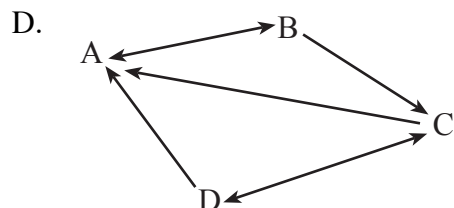
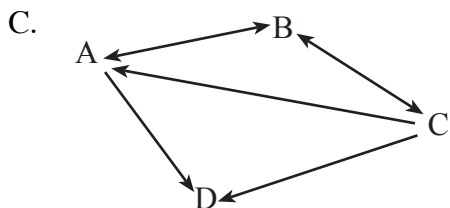
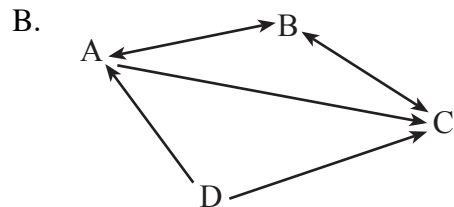
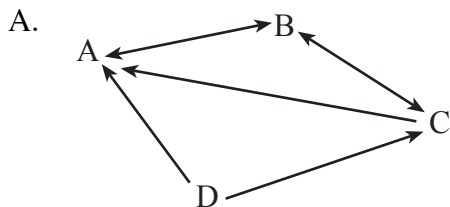
**INSTRUCTIONS:** For each question, select the **best** answer and record your choice on the Response Form provided. Using an HB pencil, completely fill in the circle that has the letter corresponding to your answer.

1. Given matrix  $A = \begin{bmatrix} 2 & 1 & 3 \\ -1 & -2 & 5 \\ -4 & 4 & -5 \end{bmatrix}$ , determine element  $a_{23}$ .

- A. -5
- B. -4
- C. 4
- D. 5

2. Which network diagram below is represented by the matrix:

	<b>To</b>	
	A B C D	
<b>From</b>	A	$\begin{bmatrix} 0 & 1 & 0 & 0 \end{bmatrix}$
	B	$\begin{bmatrix} 1 & 0 & 1 & 0 \end{bmatrix}$
	C	$\begin{bmatrix} 1 & 1 & 0 & 0 \end{bmatrix}$
	D	$\begin{bmatrix} 1 & 0 & 1 & 0 \end{bmatrix}$



3. Solve for  $c$  if:

$$2 \begin{bmatrix} -1 & 3 \\ 4 & 5 \end{bmatrix} - 3 \begin{bmatrix} 1 & 6 \\ 3 & 4 \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix}$$

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

4. A toy company with manufacturing plants in Langley and Surrey makes model cars and trucks. The production costs (materials and labour) for each toy are given in the matrices below.

	<b>Langley</b>			<b>Surrey</b>	
	Car	Truck		Car	Truck
Materials	\$3.00	\$2.50	Materials	\$3.60	\$2.70
Labour	\$6.00	\$8.00	Labour	\$5.40	\$7.40

If each plant makes the same number of trucks, determine the average cost of producing a toy truck.

- A. \$ 5.15
- B. \$ 7.70
- C. \$10.30
- D. \$20.60

5. If  $A = \begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix}$  and  $C = \begin{bmatrix} 3 & 5 \\ 4 & 7 \end{bmatrix}$ , determine matrix  $B$  if  $A + 2B = C$ .

A.  $\begin{bmatrix} 1 & 2 \\ 1 & 3 \end{bmatrix}$

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

C.  $\begin{bmatrix} 2 & 4 \\ 2 & 6 \end{bmatrix}$

D.  $\begin{bmatrix} 4 & 8 \\ 4 & 12 \end{bmatrix}$



6. Solve the following system for  $x$  only.

$$x + z = 1$$

$$2x + y = 3$$

$$x - y + z = 4$$

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

7. Given a flight matrix  $F$ , which of the following operations would be used to determine how many ways one could travel between cities either directly or with  $k$  stopovers?

- A.  $F + F^k$
- B.  $F + F^{k-1}$
- C.  $F + F^{k+1}$
- D.  $F^k + F^{k+1}$

8. If the formula  $=\text{SUM}(B1:B4)$  was entered into cell B5 in the spreadsheet below, what would be the contents of cell B5?

	A	B	C
	Value in hundreds of dollars		
1	9	4	13
2	7	9	16
3	9	16	25
4	11	25	36
5			
6			

- A. 29
- B. 36
- C. 41
- D. 54

9. Which of the following formulas will correctly average the values stored in cells G1, G2, G7 and G8 of a spreadsheet?

- A. = AVG(G1 : G8)
- B. = AVG(G1 – G8)
- C. = SUM(G1 : G8)/4
- D. = (G1 + G2 + G7 + G8)/4

10. If a truck was purchased in January 1990 for \$20 000 and then sold in January 2000 for \$2 000, what was the annual compounded rate of depreciation? (Accurate to the nearest percent.)

- A. 10%
- B. 18%
- C. 21%
- D. 26%

11. Which of the following terms best describes the sequence  $4, 2, 1, \frac{1}{2}, \dots$  ?

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

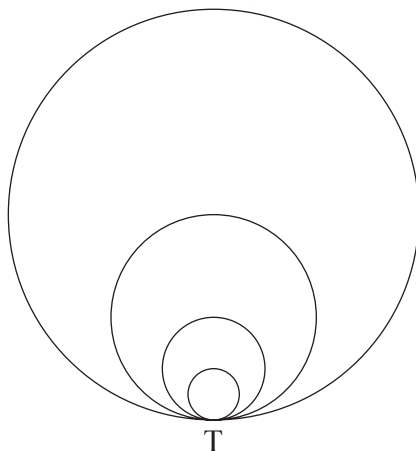
12. List the first 3 terms of the sequence generated by the formula:  $t_n = (-2)^n$

- A. -2, -4, -8
- B. -2, 4, -8
- C. 1, -2, 4
- D. 2, -4, 8

Use the following fractal to answer questions 13 and 14.

A fractal is created as follows:

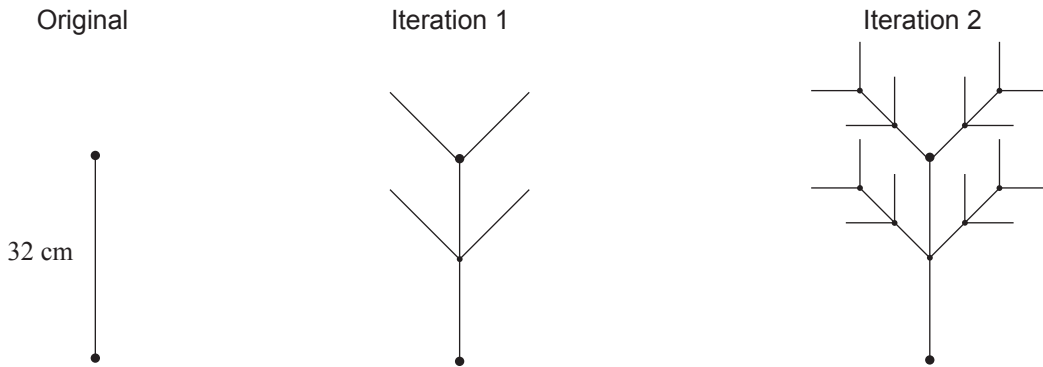
- A circle is drawn with radius 8 cm.
- A new circle is drawn that is half the radius of the previous circle.
- The new circle created is tangent to the previous circle at point T.
- This process is continued as illustrated.



13. What is the area of the 4<sup>th</sup> circle in the diagram?
- A.  $\pi \text{ cm}^2$   
B.  $\frac{\pi^2}{4} \text{ cm}^2$   
C.  $\pi^2 \text{ cm}^2$   
D.  $4\pi^2 \text{ cm}^2$
14. What is the total circumference of all the circles drawn if the process is continued forever?
- A.  $32\pi$   
B.  $64\pi$   
C.  $128\pi$   
D. the circumference is infinite

15. A “branch” fractal is created as follows:

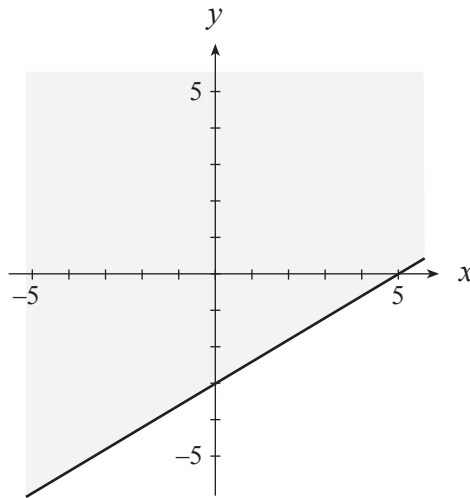
- A vertical line of length 32 cm is drawn.
- At the midpoint and the top of this segment, two branches are drawn at  $135^\circ$  to the “stem”, each half the length of the stem.
- This process is repeated with each of the branches.



If this process is continued, what is the total length of all the line segments in the 3<sup>rd</sup> iteration?

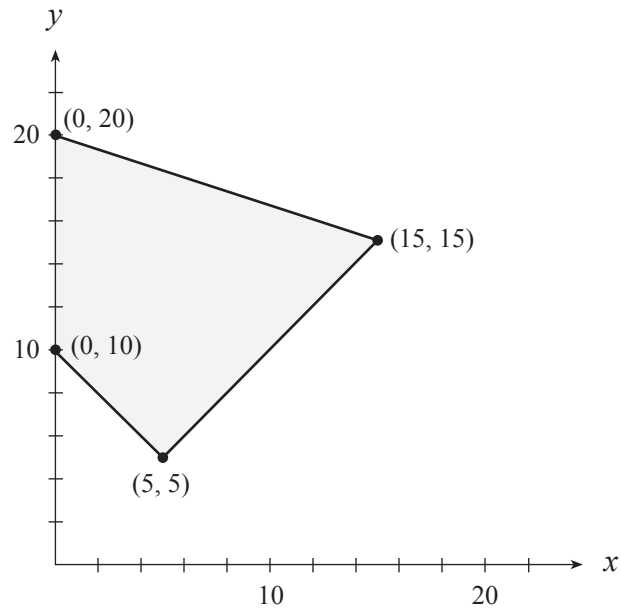
- A. 224 cm
- B. 256 cm
- C. 480 cm
- D. 512 cm

16. Which inequality best represents the shaded region graphed below?



- A.  $y \leq \frac{3}{5}x - 3$
- B.  $y \leq \frac{5}{3}x - 3$
- C.  $y \geq \frac{3}{5}x - 3$
- D.  $y \geq \frac{5}{3}x - 3$

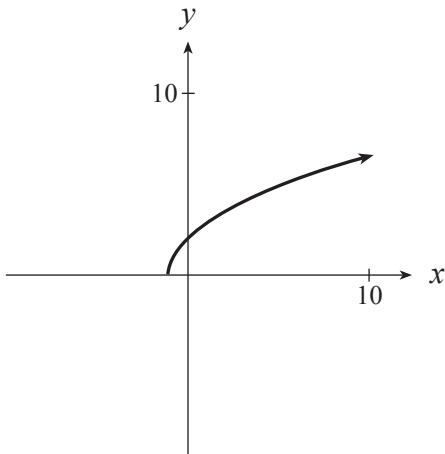
17. The graph below shows the feasible region for a linear programming problem. If  $(0, 20)$  and  $(15, 15)$  both maximize an objective function  $P$ , which of the following points also maximizes the function  $P$ ?



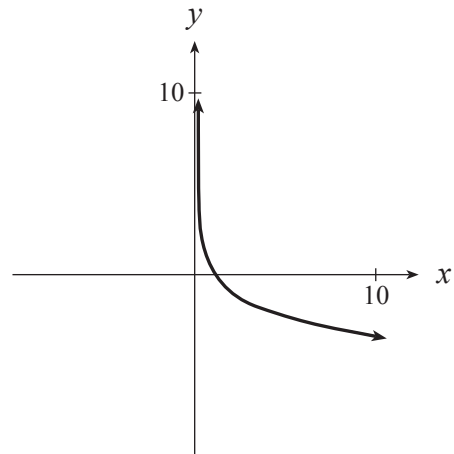
- A.  $(0, 15)$
- B.  $(5, 18)$
- C.  $(10, 10)$
- D.  $(12, 16)$

18. Which of the following best illustrates a polynomial function?

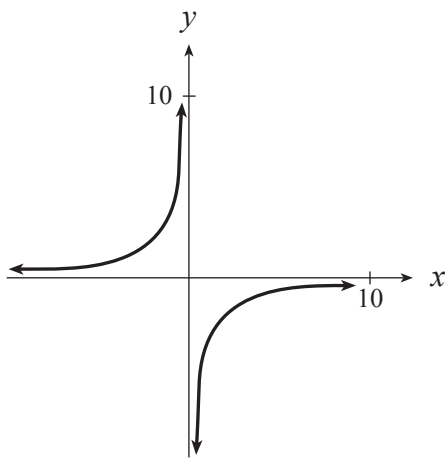
A.



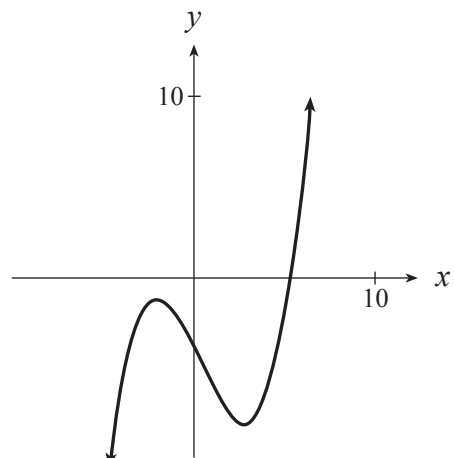
B.



C.



D.



19. The function  $P = 25\,000(1.08)^n$  is used by the planning department to predict the future population of Newtown. If  $P$  represents the population  $n$  years after January 1, 1990, predict the population of Newtown on January 1, 2005, to the nearest 100.

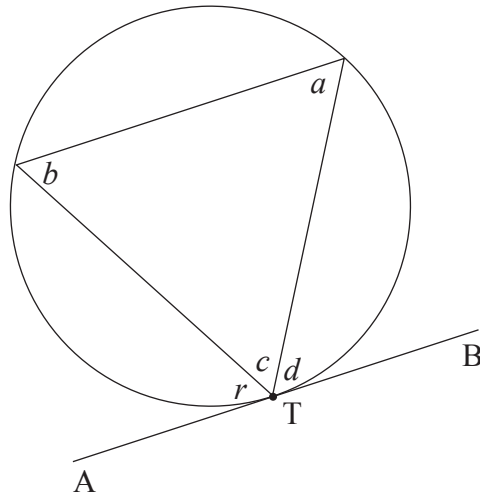
- A. 73 400
- B. 79 300
- C. 85 600
- D. 92 500

20. The number of barrels of oil,  $N$ , produced during the  $m^{\text{th}}$  month by a certain oil well is given by  $N = 500\,000(0.96)^m$ . For what value of  $m$  would production be down to 100 000 barrels?
- A. 34.0
  - B. 39.4
  - C. 40.1
  - D. 41.7
21. A toy rocket is launched from a hilltop 100 m above a lake. Its height,  $h$ , in metres is given by the formula  $h = vt - 4.9t^2 + 100$ , where  $t$  is the time after launching in seconds and  $v$  is the initial velocity in metres per second. If the rocket hits the lake 25 seconds after launching, what was the initial velocity,  $v$ ?
- A. 114.5 m/s
  - B. 118.5 m/s
  - C. 126.5 m/s
  - D. 130.5 m/s
22. The changes in a person's blood pressure over time can be modelled by a sinusoidal function. If James' blood pressure reading at time  $t$  minutes is given by the formula  $P(t) = 25 \sin(160\pi t) + 98$ , what is his maximum blood pressure reading?
- A. 73
  - B. 98
  - C. 123
  - D. 160

23. Two masses are suspended from springs and set in motion. The height of a mass, in cm,  $t$  seconds after being set in motion is described by the functions  $h_1(t) = -4 \cos(3\pi t)$  and  $h_2(t) = 3 \sin\left(\frac{5\pi}{2}t\right)$ . For what value of  $t$  will the two masses **first** be at the same height?
- A. 0.248
  - B. 0.331
  - C. 0.404
  - D. 2.786
24. A retail company selling men's suits finds its monthly profits,  $P$ , in dollars, can be approximated by the periodic function  $P(t) = 20\,000\left[1 - \cos\left(\frac{\pi}{6}t\right)\right]$ , where  $t$  is the number of months since July 1, 1995. What is the period of this function?
- A.  $\frac{1}{6}$
  - B.  $\frac{\pi}{6}$
  - C. 12
  - D.  $12\pi$
25. The deer population in the Mowichville area was at a maximum of 3 400 in June 1985, and reached its next minimum of 1 600 in June 1994. If the population function is sinusoidal with respect to time, what would the expected population be in June 2000?
- A. 2 900
  - B. 2 950
  - C. 3 189
  - D. 3 399

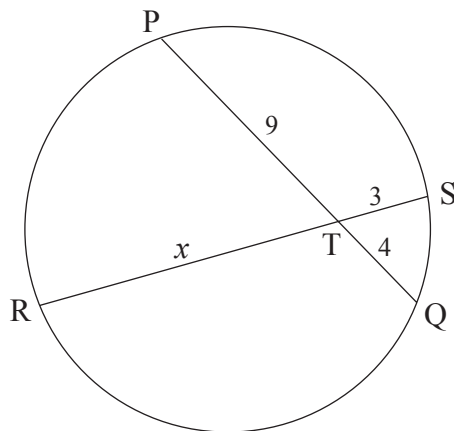


26. The segment AB is tangent to the circle at point T. Which angle is equal to  $r$ ?



- A.  $a$
- B.  $b$
- C.  $c$
- D.  $d$

27. In a circle, chords PQ and RS intersect at point T as shown in the diagram below. If  $PT = 9$ ,  $TS = 3$ ,  $TQ = 4$ ,  $RT = x$ , determine the value of  $x$ .

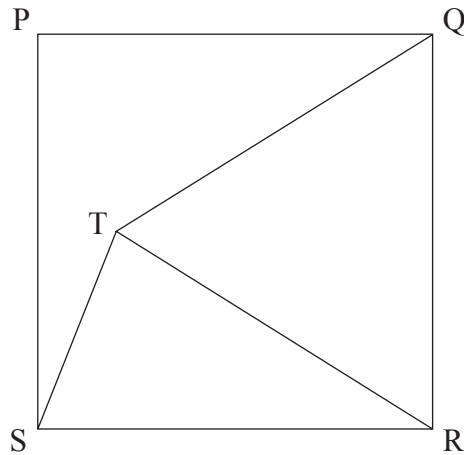


- A.  $\frac{4}{3}$
- B.  $\frac{27}{4}$
- C. 10
- D. 12

28. What is the circumference of a circle with area  $49\pi$  ?

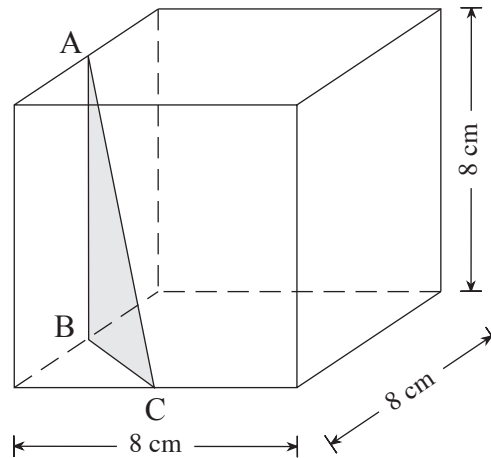
- A. 7
- B. 14
- C.  $7\pi$
- D.  $14\pi$

29. In the diagram below, PQRS is a square with sides of length 5 cm.  $\triangle RTQ$  is equilateral. Determine the measure of  $\angle PST$ .

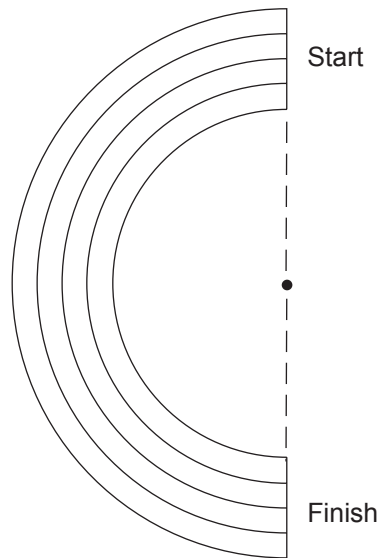


- A.  $10^\circ$
- B.  $12.5^\circ$
- C.  $15^\circ$
- D.  $17.5^\circ$

30. The midpoints A, B, C of three edges of a cubical box with sides 8 cm are joined to form a triangle, as shown in the diagram below. Find the perimeter of triangle ABC.

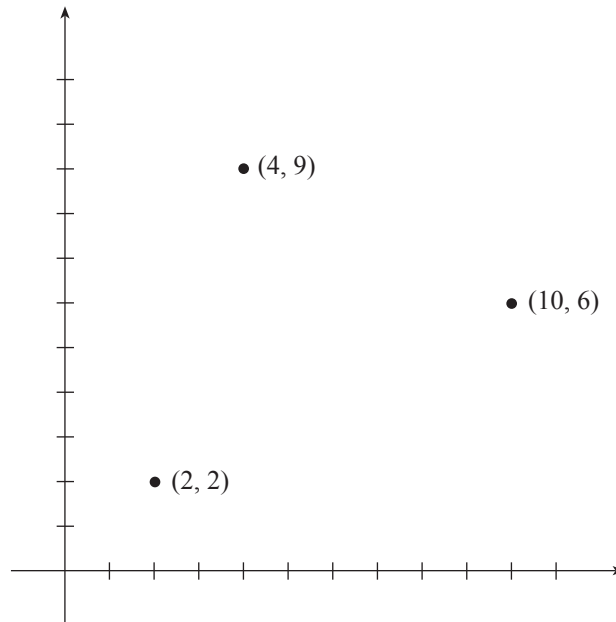


- A. 19.31 cm  
 B. 20.94 cm  
 C. 22.63 cm  
 D. 23.45 cm
31. A track is curved at one end in the shape of a semicircle. How much further does a runner in the next lane have to run to get from the start to the finish if the lanes are 1.2 m wide?



- A. 3.77 m  
 B. 4.52 m  
 C. 7.54 m  
 D. 9.05 m

32. To determine the equation of the median-median line of best fit, Josie graphed three summary points as shown in the diagram below. Which pair of points will give her the correct slope for the median-median line of best fit?



- A. (2, 2) and (4, 9)  
B. (2, 2) and (10, 6)  
C. (4, 9) and (10, 6)  
D. (4, 9) and (6, 4)
33. What is the summary point for the group of data points (2, 7), (5, 16), (7, 10) and (12, 5) for use in the median-median method of determining a line of best fit?
- A. (6, 8.5)  
B. (6, 13)  
C. (6.5, 7.5)  
D. (6.5, 9.5)

34. A least squares line of best fit is used to analyze the following data:

<b>Time (s)</b>	<b>Distance (km)</b>
5.3	14.9
5.9	15.4
6.5	17.5
7.1	18.7
7.7	20.0

Determine which data point is farthest from the line of best fit.

- A. (5.3, 14.9)
- B. (5.9, 15.4)
- C. (7.1, 18.7)
- D. (7.7, 20.0)

35. In a normal distribution, which of the following  $z$ -scores is most likely to occur?

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

36. For a real estate salesperson, the number of sales per month and the related probabilities are summarized in the table below.

<b>Number of sales per month</b>	0	1	2	3	4
<b>Probability</b>	0.50	0.30	0.10	0.07	0.03

If her average profit per sale is \$7 500, what is her expected monthly profit?

- A. \$3 750
- B. \$6 225
- C. \$7 500
- D. \$9 036

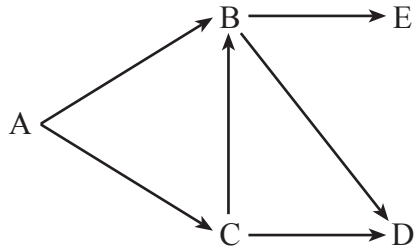
37. Twenty-five students in a class were surveyed to determine the average amount of money they earned each week. The results are summarized in the table below.

Amount earned ( $x$ )	Frequency
$\$0 \leq x < \$50$	5
$\$50 \leq x < \$100$	7
$\$100 \leq x < \$150$	6
$\$150 \leq x < \$200$	4
$\$200 \leq x < \$250$	3
$x \geq \$250$	0

Calculate an estimate of the mean amount of money earned per week by students in this class.

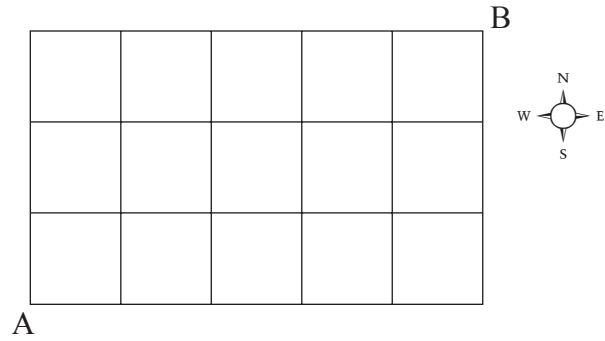
- A. \$111  
B. \$125  
C. \$136  
D. \$150
38. A chemical needs to be tested for impurities before being shipped. One hundred random samples of the chemical were tested and the mean percent of impurities found was 10.2, with a standard deviation of 2.3. Construct a 95% confidence interval for the mean percent of impurities in the chemical.
- A.  $0.301 < \mu < 4.299$   
B.  $9.690 < \mu < 10.710$   
C.  $9.749 < \mu < 10.651$   
D.  $10.155 < \mu < 10.245$
39. It is known that about 5% of coffee cups used in a particular restaurant will be chipped. What is the probability that out of 10 cups selected at random, exactly 2 will be chipped?
- A. 0.0017  
B. 0.0125  
C. 0.0746  
D. 0.2000

40. At each point in the maze below, there is an equally likely chance that either path will be chosen. What is the probability that a person entering at point A will exit at point D?



- A.  $\frac{1}{2}$   
B.  $\frac{5}{8}$   
C.  $\frac{3}{4}$   
D.  $\frac{7}{8}$
41. Determine the mean on an examination where grades of 70 and 88 have standard scores of  $-0.6$  and  $1.4$  respectively.
- A. 73.1  
B. 75.4  
C. 76.9  
D. 79.0

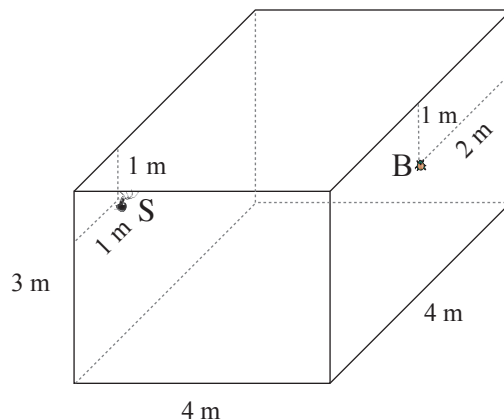
42. Annie's friend Bruno lives 3 blocks north and 5 blocks east of Annie's house. How many different routes are there from A to B if all routes progress either north or east?



- A. 21  
B. 35  
C. 56  
D. 70
43. A hut is located 4 km from the centre of a circular island. There is water 8 km due north and 12 km due south of the hut. What is the radius of the island?
- A. 8.24 km  
B. 10.10 km  
C. 10.58 km  
D. 10.95 km



44. In the diagram below, a spider, S, is located on a wall 1 m from the ceiling and 1 m from the corner. The spider wants to crawl across the ceiling to a bug, B, located 1 m from the ceiling and 2 m from the corner. If the dimensions of the room are as shown in the diagram, what is the shortest distance the spider must crawl?



- A. 5.10 m  
 B. 6.08 m  
 C. 6.32 m  
 D. 7.07 m
45. Four golf balls are tightly packed in a box that is the shape of a square-based prism. Which of the following is the best approximation of the ratio of the total volume of golf balls to the volume of air in the box?
- A. 0.62 : 1  
 B. 1.10 : 1  
 C. 1.16 : 1  
 D. 2.22 : 1

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

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## 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. A restaurant chain gathered data to relate advertising costs and sales. This is summarized in the following table:

Advertising Costs (\$)	Sales (\$)
1 000	19 000
4 000	44 000
10 000	52 000
14 000	53 000

- a) What is the correlation coefficient for the least squares line of best fit?

**(1 mark)**

ANSWER:

- b) Determine the least squares linear regression equation and predict the expected sales if \$20 000 was spent on advertising. (Give your answer to the nearest \$1 000.) **(2 marks)**

ANSWER:

**OVER**

2. A survey revealed that 30% of a certain population smokes. Each year, 20% of the smokers quit and 5% of the non-smokers start.
- a) Determine the percentage of smokers after 2 years. **(2 marks)**

ANSWER:

b) Determine the percentage of smokers in the long term.

**(1 mark)**

ANSWER:

**OVER**

3. Amy deposited \$2 000 into a savings fund earning 9% compounded annually on each of her 24<sup>th</sup>, 25<sup>th</sup> and 26<sup>th</sup> birthdays. If she makes no additional deposits after these three, but leaves the accumulated amount in the account earning 9% compounded annually, how much will she have in the account when she retires on her 60<sup>th</sup> birthday? **(3 marks)**



ANSWER:

4. A newly developed antibiotic causes harmful side effects in 25% of the patients treated with the drug. If this medication is given to 100 randomly selected patients, what is the probability that 30 or more of them will suffer from these side effects? **(3 marks)**

ANSWER:

**OVER**

5. A car rental company has 200 cars. The company can rent out all the cars if the price is \$36 per day. With each \$2 increase per day, 5 fewer cars are rented out. What is the maximum net revenue? **(3 marks)**

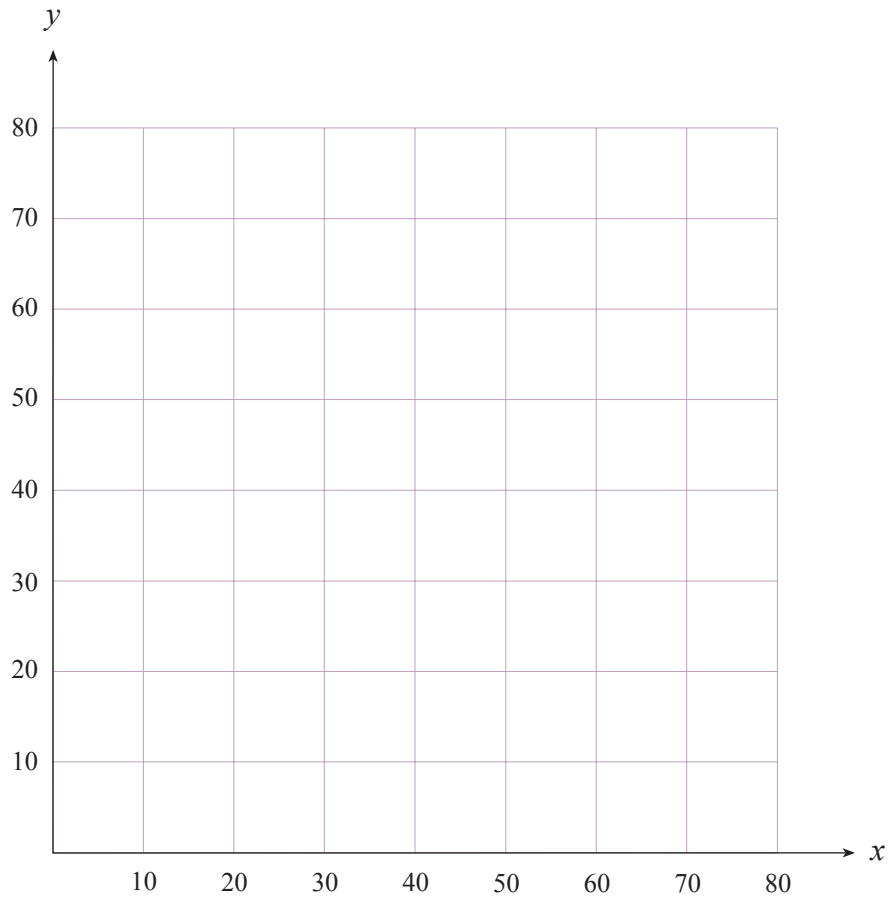
ANSWER:

6. Fertilizer requirements and costs for maintaining the grass at a golf course are outlined in the table below.

	Type A	Type B	Minimum required
	kilograms per m <sup>3</sup>		
Phosphoric acid	20	10	690
Nitrogen	30	30	1 440
Potash	5	10	330
Cost per m <sup>3</sup>	\$30	\$35	

Let  $x$  represent the number of m<sup>3</sup> of Type A fertilizer and  $y$  represent the number of m<sup>3</sup> of Type B fertilizer. List the constraints and objective function, then solve the linear programming problem to determine the minimum cost of fertilizer for the golf course.

**(4 marks)**

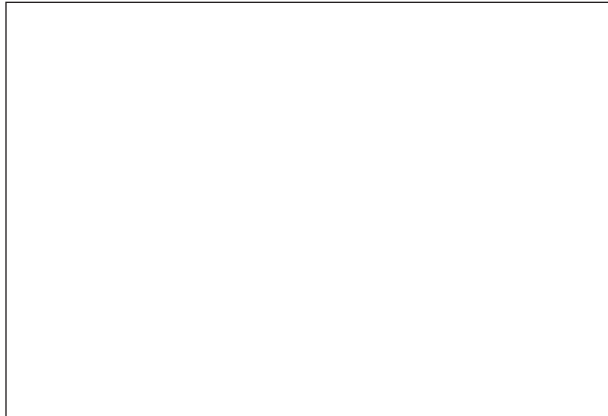


ANSWER:

**OVER**

7. The formula  $D = 10 \log\left(\frac{5 \times 10^{10}}{r^2}\right)$  gives the decibel level,  $D$ , of sound at a rock concert at  $r$  rows back from the stage. How many rows back can Jen sit and still hear the music at a level of at least 80 decibels? **(2 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.



$Y_1 =$

$Y_2 =$

$Y_3 =$

$Y_4 =$

[            ,            ]            [            ,            ]

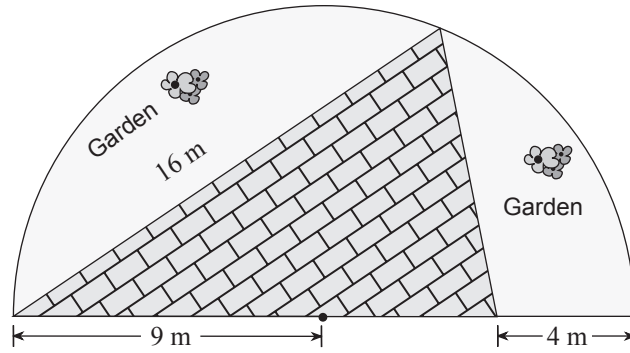
$x$              $x$   
min            max

$y$              $y$   
min            max



ANSWER:

8. A solarium is semicircular in shape with a radius of 9 m. It consists of a triangular-tiled area and gardens in the non-tiled area, as shown in the diagram.



a) Determine the area of the garden.

**(3 marks)**

ANSWER:

- b) If the topsoil in the garden is 0.2 m deep and costs \$25/m<sup>3</sup>, determine the cost of the topsoil. **(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:

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

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

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

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

$$\mu = np$$

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

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

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

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

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

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

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

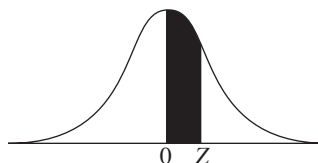
**Note:** Graphing calculators will contain many of these formulae as pre-programmed functions.

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# TABLE OF Z-SCORES

## Z = Z-Score

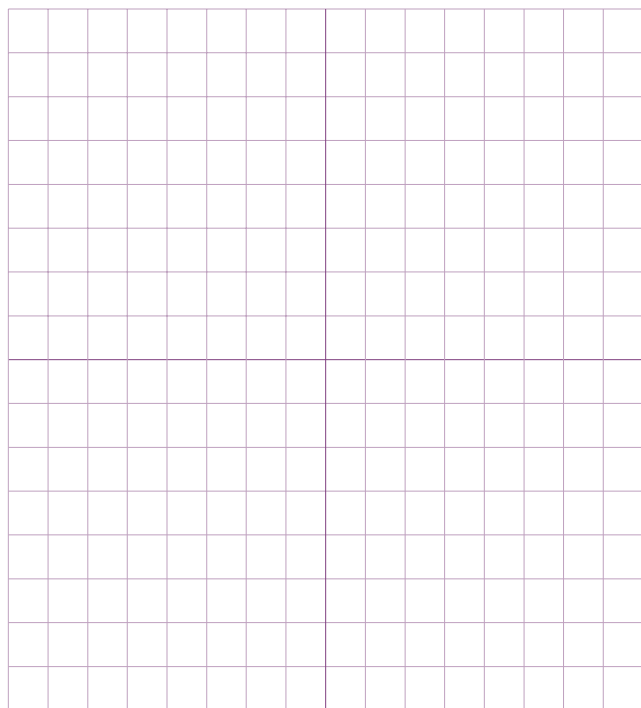
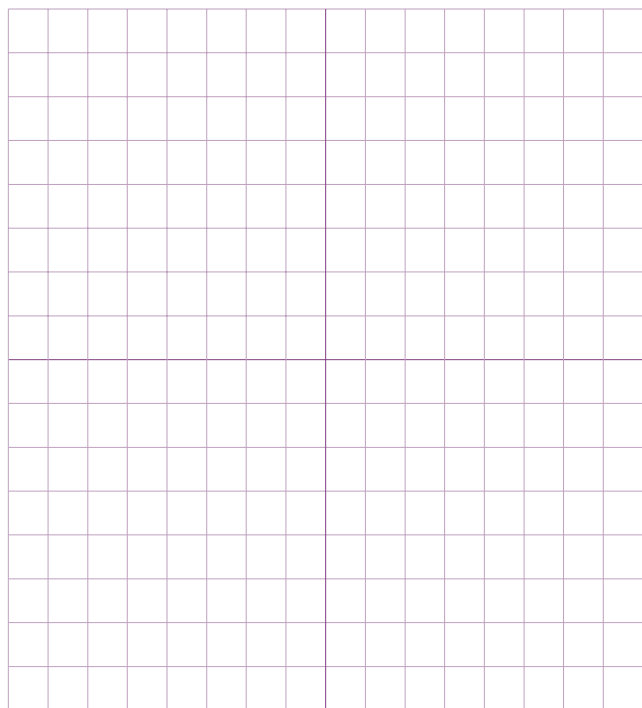
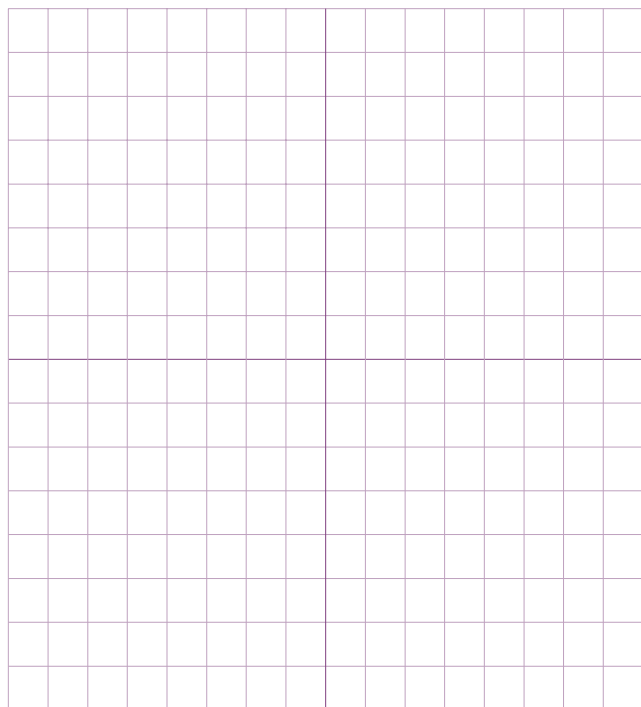
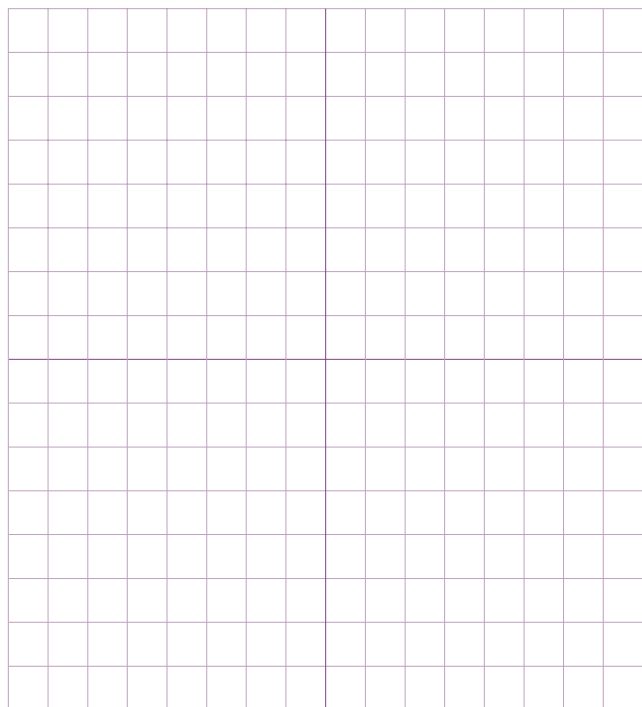
An entry in the table is the area under the curve between  $Z = 0$  and a positive value of  $Z$ . Areas for negative values of  $Z$  are obtained by symmetry.



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**

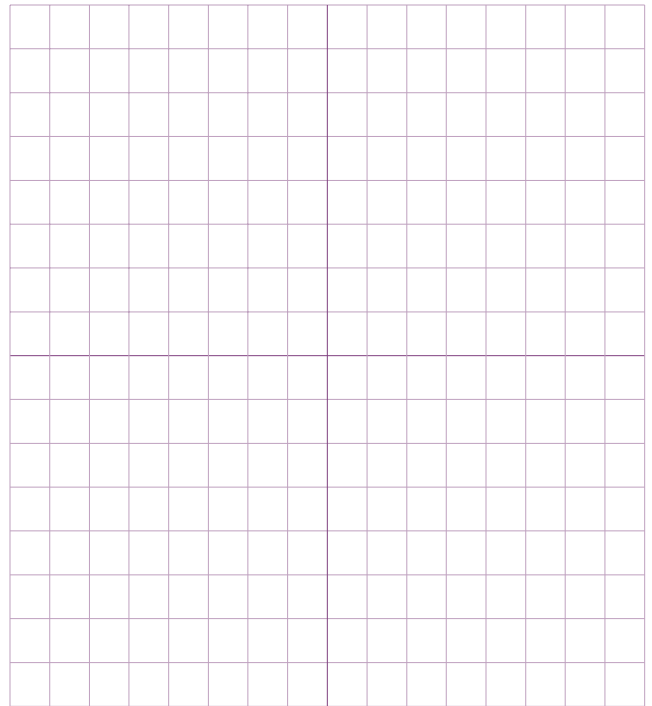
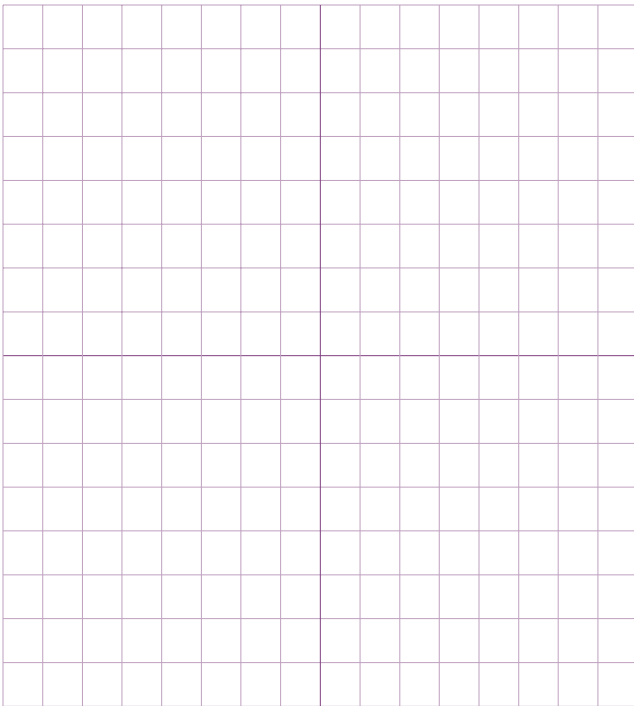
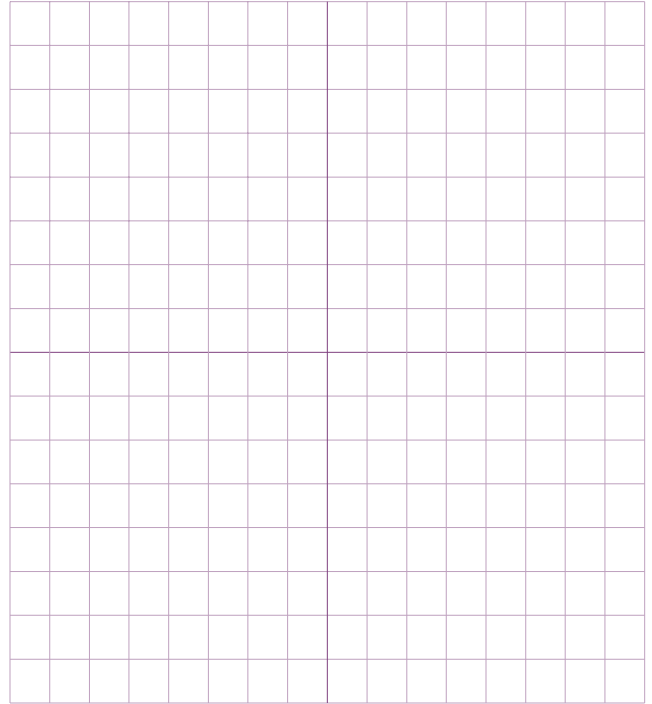
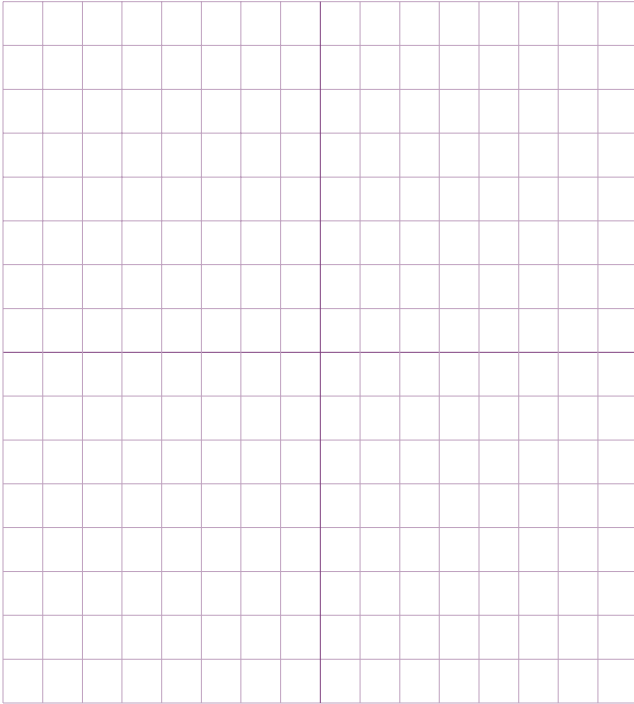
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## ROUGH WORK FOR MULTIPLE-CHOICE



