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## Principles of Mathematics 12

June 2003

Course Code = MA

### 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.  .

(2)

Question 5b:

8.  .

(2)

Question 1b:

2.  .

(2)

Question 6a:

9.  .

(2)

Question 2:

3.  .

(4)

Question 6b:

10.  .

(2)

Question 3:

4.  .

(5)

Question 7a:

11.  .

(3)

Question 4a:

5.  .

(2)

Question 7b:

12.  .

(1)

Question 4b:

6.  .

(2)

Question 8:

13.  .

(5)

Question 5a:

7.  .

(2)

# **PRINCIPLES OF MATHEMATICS 12**

**June 2003**

COURSE CODE = MA

## 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.*

## PRINCIPLES OF MATHEMATICS 12 PROVINCIAL EXAMINATION

- |   | Value                   | Suggested Time     |
|---|-------------------------|--------------------|
| 1. This examination consists of <b>two</b> parts: |                         |                    |
| PART A: 44 multiple-choice questions              | 66                      | 75                 |
| PART B: 8 written-response questions              | 34                      | 45                 |
|   | <b>Total: 100 marks</b> | <b>120 minutes</b> |
2. The last **four** pages inside the back cover contain **A Summary of Basic Identities and 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 Principles 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 graphing 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 values. If the statistical features of the calculator are used, it is important to show the function with the substitution of the relevant numbers. For example: in part of the solution it is acceptable to show  $\text{normalcdf}(10, 40, 50, 20)$  or the equivalent syntax for the calculator used.
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: 66 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. Convert  $120^\circ$  to radians.

A.  $\frac{2\pi}{3}$

B.  $\frac{5\pi}{6}$

C.  $\frac{3\pi}{2}$

D.  $\frac{6\pi}{5}$

2. Determine the amplitude of  $y = -2 \sin 4\left(x - \frac{\pi}{3}\right) + 3$ .

A.  $-2$

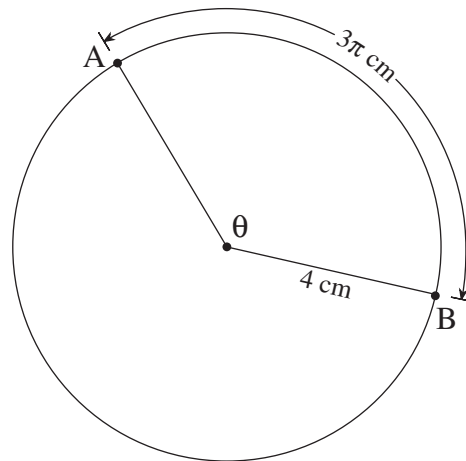
B.  $2$

C.  $3$

D.  $4$

**OVER**

3. A circle has a radius of 4 cm. If the length of arc AB shown on the diagram is  $3\pi$  cm, determine the measure of the central angle  $\theta$  in radians.

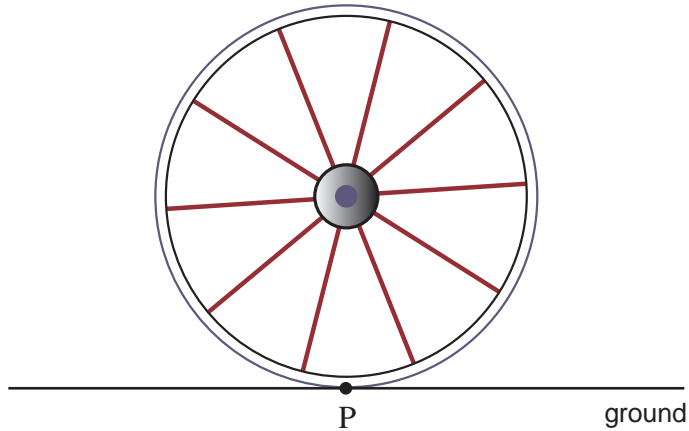


- A.  $\frac{3\pi}{4}$   
B.  $\frac{4}{3\pi}$   
C.  $\frac{3\pi}{2}$   
D.  $3\pi$
4. Solve:  $\tan x - \cos x = -2$ ,  $0 \leq x < 2\pi$
- A. 1.17, 4.10  
B. 1.97, 5.32  
C. 1.17, 1.57, 4.10, 4.71  
D. 1.57, 1.97, 4.71, 5.32
5. Solve:  $4 \cos^2 x = 3$ ,  $0 \leq x < 2\pi$

- A.  $\frac{\pi}{6}, \frac{11\pi}{6}$   
B.  $\frac{\pi}{3}, \frac{5\pi}{3}$   
C.  $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$   
D.  $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$



6. A wheel with diameter 10 cm is rolling along the ground. Point P on the edge of the wheel is on the ground as shown in the diagram at time  $t = 0$  seconds. Which equation gives the height,  $h$ , of point P above the ground at time  $t$  seconds, if the wheel rotates once every 12 seconds?



- A.  $h = -5 \cos \frac{\pi}{12} t$
- B.  $h = -5 \cos \frac{\pi}{6} t$
- C.  $h = -5 \cos \frac{\pi}{12} t + 5$
- D.  $h = -5 \cos \frac{\pi}{6} t + 5$
7. Determine an expression equivalent to  $\tan \theta + \cot \theta$ .
- A. 1
- B.  $\sin \theta \cos \theta$
- C.  $\sec \theta \csc \theta$
- D.  $\sin \theta + \cos \theta$

8. The point  $(p, q)$  is the point of intersection of the terminal arm of angle  $\theta$  in standard position and the unit circle centred at  $(0, 0)$ . Which expression represents  $\sec \theta$ ?

A.  $q$

B.  $p$

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

D.  $\frac{1}{p}$

9. Which expression is equivalent to  $6 \sin 8x \cos 8x$ ?

A.  $\sin 8x$

B.  $\sin 16x$

C.  $3 \sin 4x$

D.  $3 \sin 16x$

10. Determine the equations of the asymptotes of the function  $y = \tan bx$ , where  $b > 0$ .

A.  $x = \frac{n\pi}{b}$ ,  $n$  is an integer

B.  $x = \frac{n\pi}{2b}$ ,  $n$  is an integer

C.  $x = \frac{\pi}{b} + \frac{n\pi}{b}$ ,  $n$  is an integer

D.  $x = \frac{\pi}{2b} + \frac{n\pi}{b}$ ,  $n$  is an integer

11. Determine the common ratio of the geometric sequence  $24, -36, 54, -81, \dots$
- A.  $-\frac{3}{2}$
  - B.  $-\frac{2}{3}$
  - C.  $\frac{2}{3}$
  - D.  $\frac{3}{2}$
12. Calculate the 15<sup>th</sup> term of the geometric sequence  $1.1, 1.32, 1.584, 1.9008, \dots$
- A. 14.12
  - B. 16.95
  - C. 48.76
  - D. 64.36
13. Determine the sum of the first 10 terms of the geometric series  $100 + 250 + 625 + \dots$
- A. 254 246.48
  - B. 381 469.73
  - C. 635 716.21
  - D. 953 674.32
14. Simplify:  $\sum_{k=3}^5 \log k$
- A.  $\log 12$
  - B.  $\log 15$
  - C.  $\log 60$
  - D.  $\log 120$

**OVER**

15. A ball is dropped from a height of 10 m. After each bounce, the ball rises to 80% of its previous height. What is the total vertical distance that the ball travels before it comes to rest?
- A. 22.5 m
  - B. 50 m
  - C. 90 m
  - D. 100 m
16. Evaluate:  $\log_2 700$
- A. 1.42
  - B. 2.54
  - C. 3.37
  - D. 9.45
17. Change to exponential form:  $\log_x 125 = \frac{3}{2}$
- A.  $125 = x^{\frac{3}{2}}$
  - B.  $125 = \left(\frac{3}{2}\right)^x$
  - C.  $x^{125} = \frac{3}{2}$
  - D.  $125^{\frac{3}{2}} = x$
18. Determine the domain of the function  $y = \log(3x - 5)$ .
- A.  $x > -\frac{5}{3}$
  - B.  $x > -\frac{3}{5}$
  - C.  $x > \frac{3}{5}$
  - D.  $x > \frac{5}{3}$

19. Express as a single logarithm:

$$\log a - 2 \log b - \log c$$

A.  $\log \frac{ac}{2b}$

B.  $\log \frac{ac}{b^2}$

C.  $\log \frac{a}{2bc}$

D.  $\log \frac{a}{b^2c}$

20. Solve for  $x$ :  $8^{x-1} = \left(\frac{1}{16}\right)^{5-x}$

A.  $-\frac{19}{4}$

B.  $-3$

C.  $\frac{23}{7}$

D.  $17$

21. An earthquake off the coast of Alaska measured 6.4 on the Richter scale. Another earthquake near Japan was 50 times as intense. What was the Richter scale reading for the earthquake near Japan?

A. 7.1

B. 7.9

C. 8.1

D. 10.9

22. Which expression gives the amount that an investment of  $P$  dollars will grow to after 4 years if it is compounded semi-annually at a rate of 5% per annum?

A.  $P(1.05)^4$

B.  $P(1.025)^4$

C.  $P(1.05)^8$

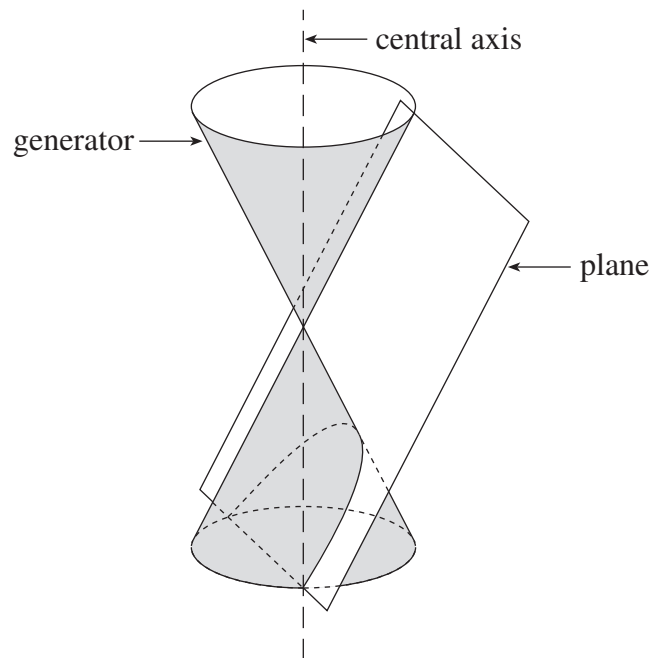
D.  $P(1.025)^8$

**OVER**

23. Given that  $y_1 = \log_a 0.4$  and  $y_2 = \log_a 4$ , where  $0 < a < 1$ , which of the following **must** be true?

- A.  $y_1 < y_2$
- B.  $y_1 > y_2$
- C.  $0.4 < y_1 < 4$
- D.  $0.4 < y_2 < 4$

24. When a plane is parallel to the generator of a double-napped cone, as shown in the diagram, the intersection of the plane and the cone forms which conic section?



- A. circle
- B. ellipse
- C. parabola
- D. hyperbola

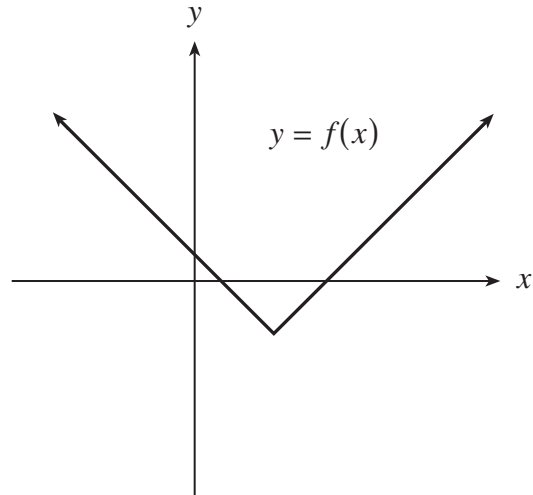
25. Determine the vertex of the parabola:

$$x = 2(y + 1)^2 - 4$$

- A.  $(-1, -4)$
- B.  $(-4, -1)$
- C.  $(1, 4)$
- D.  $(4, 1)$

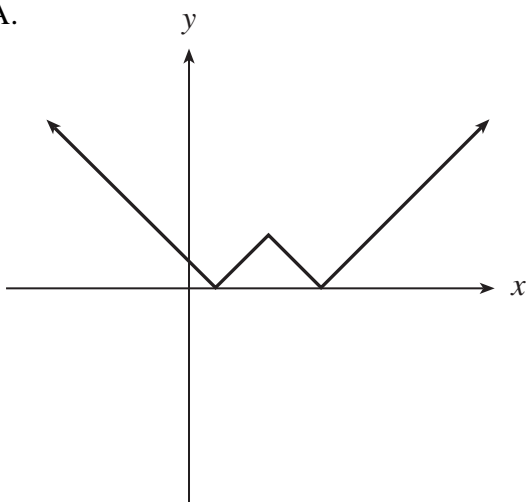
26. The length of the transverse axis of a hyperbola is 12. The equations of the asymptotes for the hyperbola are  $y = \pm \frac{2}{3}x$ . If the vertices of the hyperbola are on the  $y$ -axis, determine its equation.
- A.  $\frac{x^2}{9} - \frac{y^2}{4} = -1$
- B.  $\frac{x^2}{16} - \frac{y^2}{36} = -1$
- C.  $\frac{x^2}{36} - \frac{y^2}{16} = -1$
- D.  $\frac{x^2}{81} - \frac{y^2}{36} = -1$
27. The equation  $Ax^2 + By^2 + Cy = 0$  represents an ellipse. If  $0 < A < B < C$ , then the vertices of the ellipse are on
- A. the  $y$ -axis.
- B. the  $x$ -axis.
- C. a line parallel to the  $y$ -axis.
- D. a line parallel to the  $x$ -axis.
28. The graph of  $y = -f(x)$  is a reflection of the graph of  $y = f(x)$  in which line?
- A. the  $y$ -axis
- B. the  $x$ -axis
- C. the line  $y = x$
- D. the line  $y = -x$

29. The graph of the function  $y = f(x)$  is shown below.

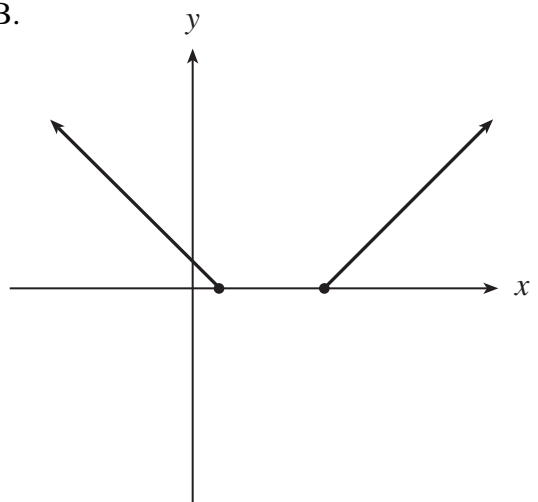


Which of the following is the graph of  $y = |f(x)|$ ?

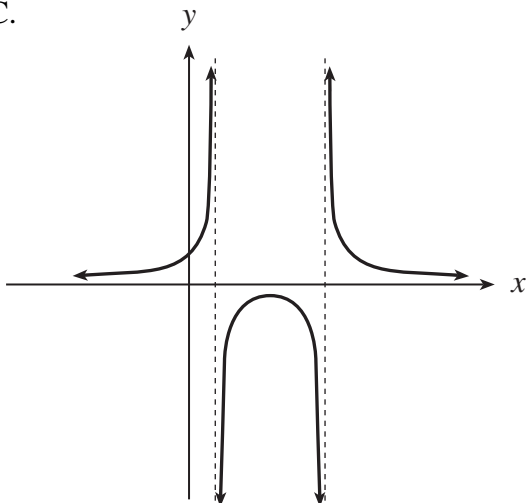
A.



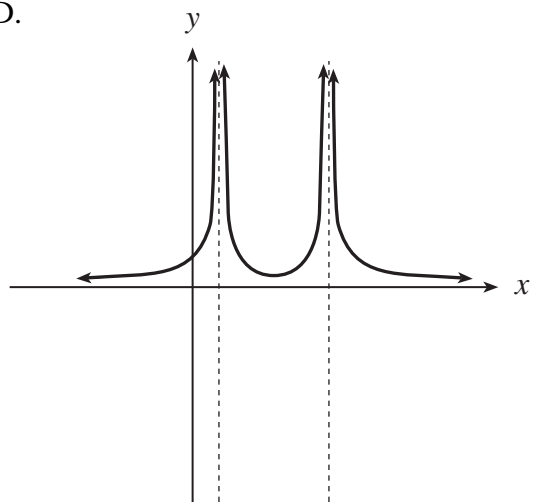
B.



C.



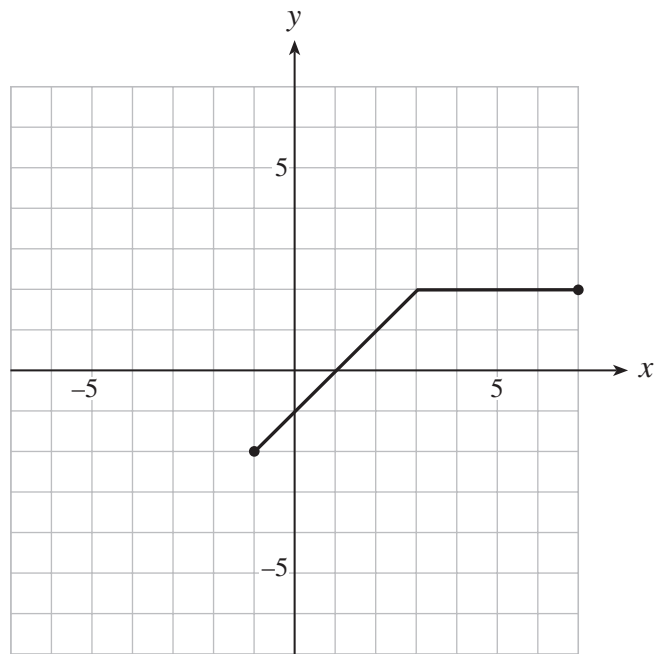
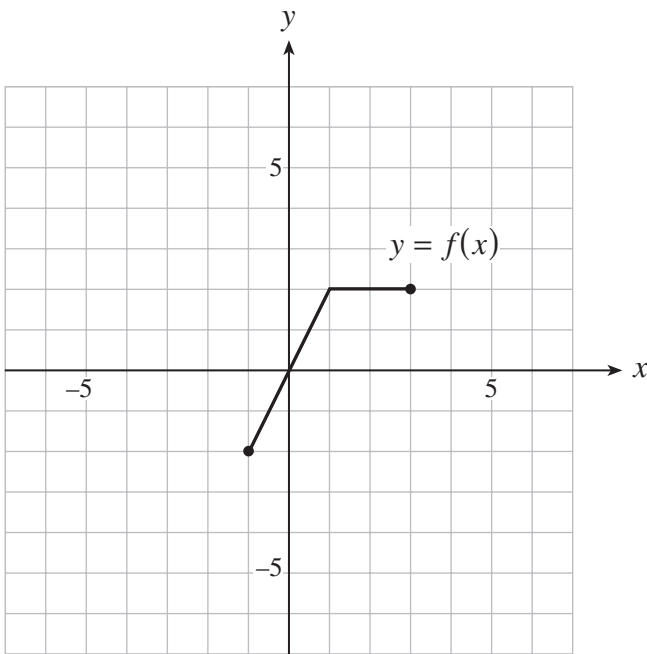
D.





30. The point  $(6, -12)$  is on the graph of the function  $y = f(x)$ . Which point must be on the graph of the function  $y = 3f(-x)$  ?
- A.  $(-6, -36)$
  - B.  $(6, 36)$
  - C.  $(-6, -4)$
  - D.  $(6, 4)$

31. The function  $y = f(x)$  is graphed to the left below. Determine the equation of the function shown to the right.



- A.  $y = f(2(x-1))$
- B.  $y = f\left(\frac{1}{2}(x-1)\right)$
- C.  $y = 2f(x-1)$
- D.  $y = \frac{1}{2}f(x-1)$

32. If the point  $(a, b)$  is on the graph of  $y = f(x)$ , which point must be on the graph

of  $y = \frac{1}{f(x-2)}$ ? ( $a \neq 0, b \neq 0$ )

A.  $\left(a-2, \frac{1}{b}\right)$

B.  $\left(a+2, \frac{1}{b}\right)$

C.  $\left(\frac{1}{a}, b\right)$

D.  $(a+2, b)$

33. An ellipse is defined by the equation  $\frac{x^2}{144} + \frac{y^2}{36} = 1$ . Determine the equation of the ellipse formed when the original ellipse has undergone a horizontal compression by a factor of  $\frac{1}{2}$  and a vertical expansion by a factor of 3.

A.  $\frac{x^2}{36} + \frac{y^2}{4} = 1$

B.  $\frac{x^2}{36} + \frac{y^2}{324} = 1$

C.  $\frac{x^2}{576} + \frac{y^2}{4} = 1$

D.  $\frac{x^2}{576} + \frac{y^2}{324} = 1$

34. How many terms are in the expansion of  $(2x + y)^9$ ?

A. 8

B. 9

C. 10

D. 11

35. Simplify:  $\frac{(n-2)!}{(n-1)!}$

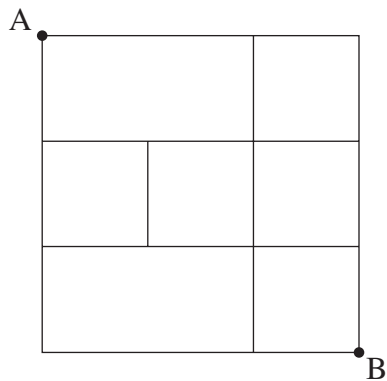
A.  $\frac{n-3}{n-1}$

B.  $n-2$

C.  $\frac{1}{n-1}$

D.  $\frac{1}{n(n-1)}$

36. Moving only to the right or down, how many different routes are there from A to B?



A. 10

B. 12

C. 14

D. 18

37. A card is randomly drawn from a standard 52-card deck. Determine the probability that the card drawn is a red ace.

A.  $\frac{1}{26}$

B.  $\frac{1}{13}$

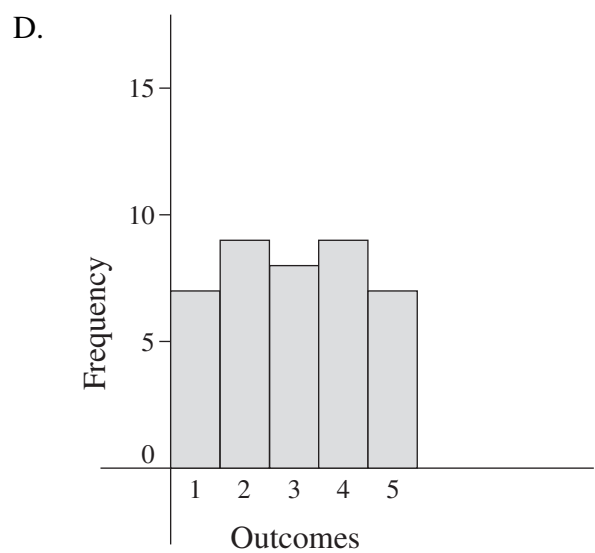
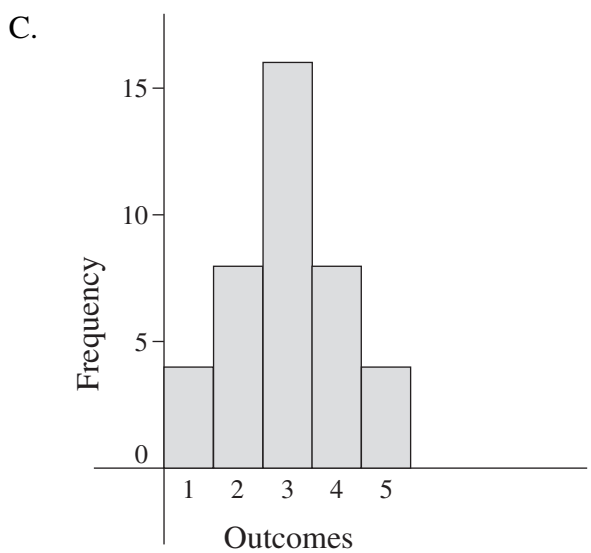
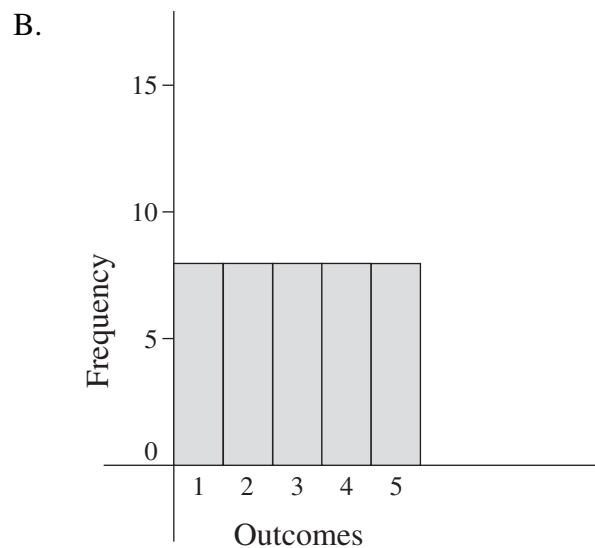
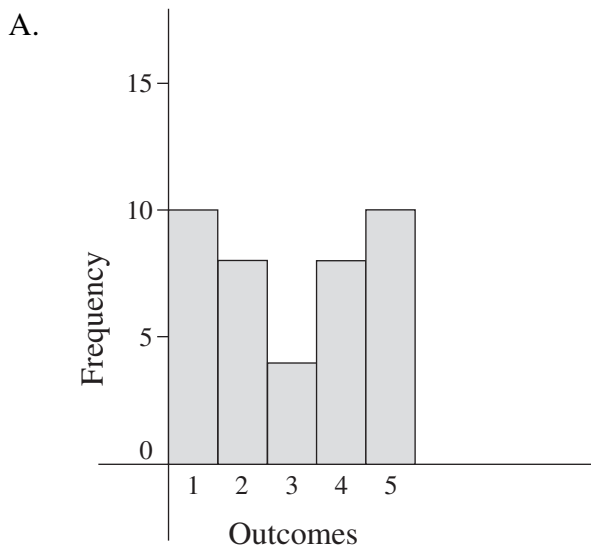
C.  $\frac{2}{13}$

D.  $\frac{4}{13}$

38. In a recent survey it was determined that out of 100 people, 70 had eaten Chinese food in the last year, 22 had eaten Italian food, and 20 had eaten neither. How many people had eaten both Chinese and Italian food in the last year?
- A. 8
  - B. 10
  - C. 12
  - D. 28
39. On Friday the probability that the Flyers win their game in Prince George is  $\frac{5}{9}$  and the probability that the Bears win their game in Smithers is  $\frac{12}{17}$ . Assuming independence, what is the probability that on Friday the Flyers win their game and the Bears do not win their game?
- A.  $\frac{20}{153}$
  - B.  $\frac{25}{153}$
  - C.  $\frac{105}{153}$
  - D.  $\frac{130}{153}$
40. Five balls are randomly drawn without replacement from a bag containing 4 red balls and 6 black balls. What is the probability that at least 3 red balls will be drawn?
- A. 0.0238
  - B. 0.2381
  - C. 0.2619
  - D. 0.7381

41. For every normal distribution, about what percentage of the area under the curve is within 1 standard deviation of the mean?
- A. 34%
  - B. 68%
  - C. 95%
  - D. 99.7%

42. Which frequency distribution shows the set of outcomes with the greatest standard deviation?



43. The IQ scores for a population are normally distributed with a mean of 100 and a standard deviation of 15. Determine the proportion of the population that has an IQ greater than 120.
- A. 0.02
  - B. 0.07
  - C. 0.09
  - D. 0.16
44. In a standard normal distribution, what is the value of  $a$  if  $P(a < Z < 0) = 0.3$  ?
- A.  $-0.84$
  - B.  $-0.52$
  - C.  $0.52$
  - D.  $0.84$

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

## PART B: WRITTEN RESPONSE

Value: 34 marks

Suggested Time: 45 minutes

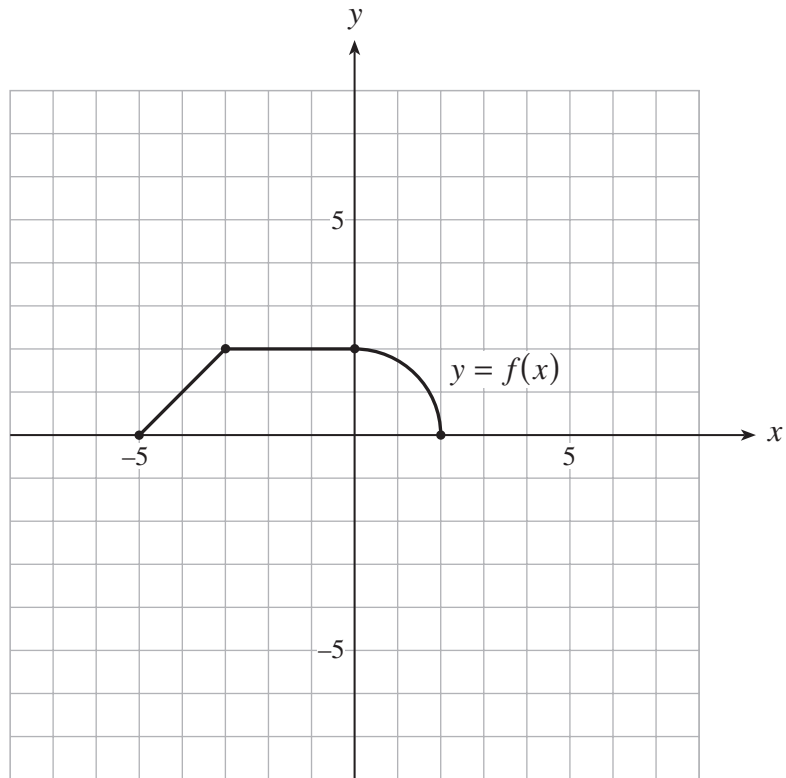
**INSTRUCTIONS:** Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question. Where required, place the final answer for each question in the space provided.

If, in a justification, you refer to information produced by the graphing 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 values. If the statistical features of the calculator are used, it is important to show the function with the substitution of the relevant numbers. For example: in part of the solution it is acceptable to show  $\text{normalcdf}(10, 40, 50, 20)$  or the equivalent syntax for the calculator used.

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.**

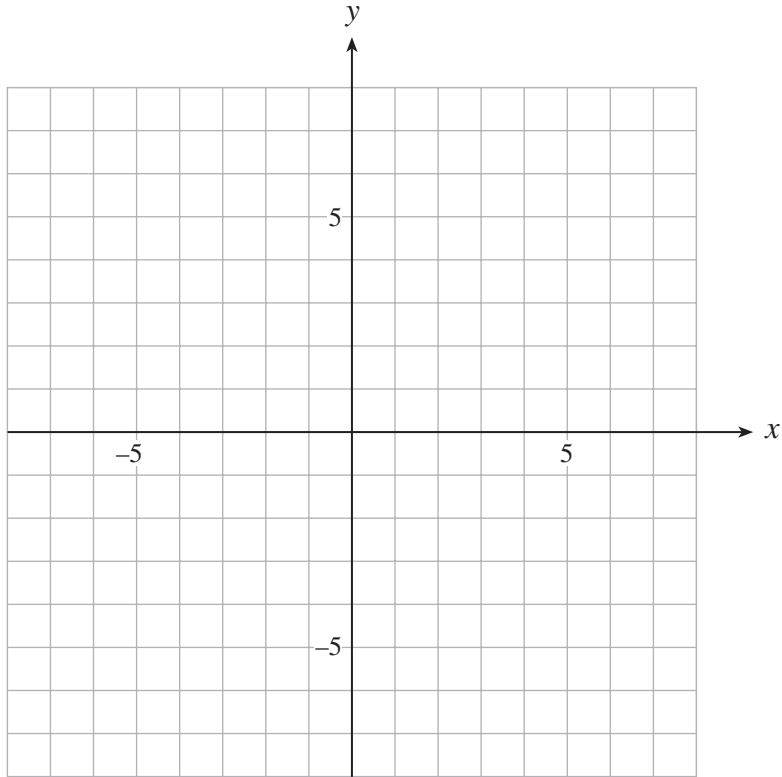
1. The graph of  $y = f(x)$  is shown below.





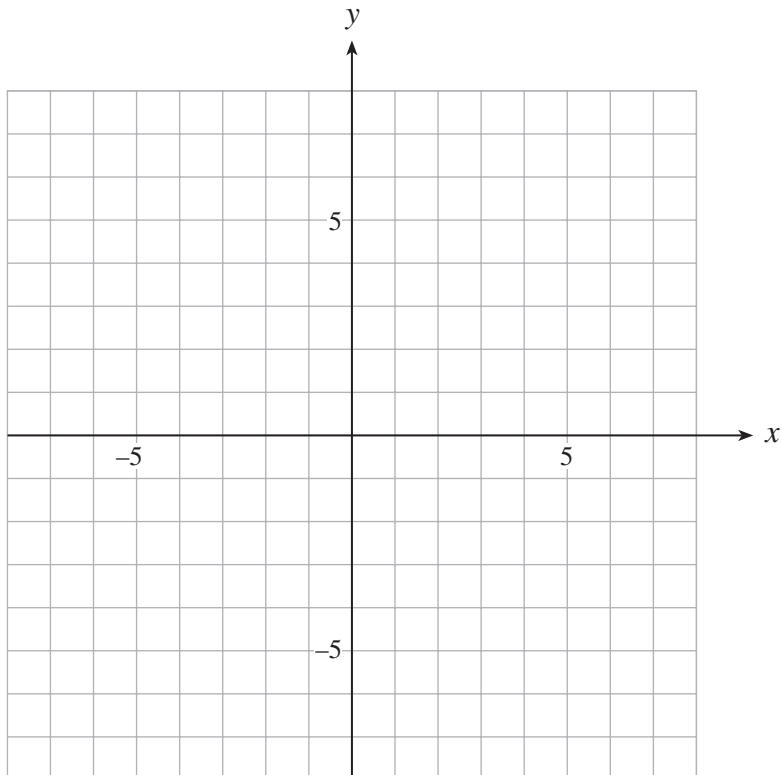
a) On the grid provided, sketch the graph of  $y = 2f(x) - 3$ .

(2 marks)



b) On the grid provided, sketch the inverse relation of  $y = f(x)$ .

(2 marks)



2. Change to standard form:

**(4 marks)**

$$3x^2 - 2y^2 - 6x - 12y - 27 = 0$$

ANSWER:

3. If 200 g of a substance decays to 17 g in 28 days, determine the half-life of this substance.  
(Solve algebraically using logarithms. Answer accurate to at least 2 decimal places.) **(5 marks)**

ANSWER:

4. There are 7 boys and 5 girls in a group of students.

- a) Calculate the number of ways that a committee of 4 students can be chosen from this group if the committee must have exactly 1 boy. **(2 marks)**

ANSWER:

- b) If the committee of 4 students must have a female president, a male vice-president, and 2 other members chosen from the remaining students, how many ways can such a committee be chosen? **(2 marks)**

ANSWER:

**OVER**

5. Bag A contains 5 white balls and 2 green balls. Bag B contains 3 white balls and 4 green balls. A fair die is rolled and if a 1 or 2 comes up, a ball is randomly selected from Bag A; however, if a 3, 4, 5 or 6 comes up, a ball is randomly selected from Bag B.



Bag A



Bag B

- a) What is the probability of selecting a white ball?

**(2 marks)**

ANSWER:



b) If a white ball is selected, what is the probability that this ball came from Bag A? **(2 marks)**

ANSWER:

**OVER**

6. Sixty-four percent (64%) of Principles of Mathematics students also take a Calculus course. If 175 Principles of Mathematics students are randomly selected, determine the probability that exactly 110 of these students also take a Calculus course by using the following methods.

- a) Use the binomial distribution to obtain this probability.  
(Answer accurate to at least 4 decimal places.)

**(2 marks)**

ANSWER:

- b) Use the normal approximation to the binomial to obtain an estimate of this probability.  
(Answer accurate to at least 4 decimal places.) **(2 marks)**

ANSWER:

7. a) Solve algebraically, giving exact values for  $x$ , where  $0 \leq x < 2\pi$ .

**(3 marks)**

$$2 \sin^2 x - \sin x = 0$$

ANSWER:

- b) Give the general solution for this equation.  
(Solve over the set of real numbers, giving exact value solutions.)

**(1 mark)**

ANSWER:

8. Prove:

(5 marks)

$$\frac{\cot \theta}{\sin \theta - \csc \theta} = -\sec \theta$$

LEFT SIDE

RIGHT SIDE

**END OF EXAMINATION**

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## A SUMMARY OF BASIC IDENTITIES AND FORMULAE

### Pythagorean Identities:

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

### Reciprocal and Quotient Identities:

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\csc \theta = \frac{1}{\sin \theta}$$

$$\cot \theta = \frac{1}{\tan \theta}$$

$$\tan \theta = \frac{\sin \theta}{\cos \theta}$$

$$\cot \theta = \frac{\cos \theta}{\sin \theta}$$

### Addition Identities:

$$\cos(\alpha + \beta) = \cos \alpha \cos \beta - \sin \alpha \sin \beta$$

$$\sin(\alpha + \beta) = \sin \alpha \cos \beta + \cos \alpha \sin \beta$$

$$\cos(\alpha - \beta) = \cos \alpha \cos \beta + \sin \alpha \sin \beta$$

$$\sin(\alpha - \beta) = \sin \alpha \cos \beta - \cos \alpha \sin \beta$$

### Double-Angle Identities:

$$\cos 2\theta = \cos^2 \theta - \sin^2 \theta$$

$$\sin 2\theta = 2 \sin \theta \cos \theta$$

$$= 2 \cos^2 \theta - 1$$

$$= 1 - 2 \sin^2 \theta$$

### Formulae:

$$t_n = ar^{n-1} \quad S_n = \frac{a(1-r^n)}{1-r} \quad S_n = \frac{a-r\ell}{1-r} \quad S = \frac{a}{1-r} \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

### Probability and Statistics:

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

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

$$t_{k+1} = {}_n C_k a^{n-k} b^k$$

$$P(\bar{A}) = 1 - P(A)$$

$$P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$$

$$P(A | B) = \frac{P(A \text{ and } B)}{P(B)}$$

$$P(A \text{ and } B) = P(A) \times P(B | A)$$

$$P(x) = {}_n C_x p^x q^{n-x} \quad (q = 1 - p)$$

$$\mu = \frac{\sum x_i}{n}$$

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

$$\mu = np$$

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

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

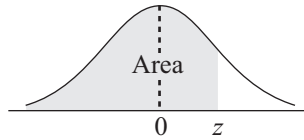
**Note:** Graphing calculators will contain many of these formulae as pre-programmed functions.

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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

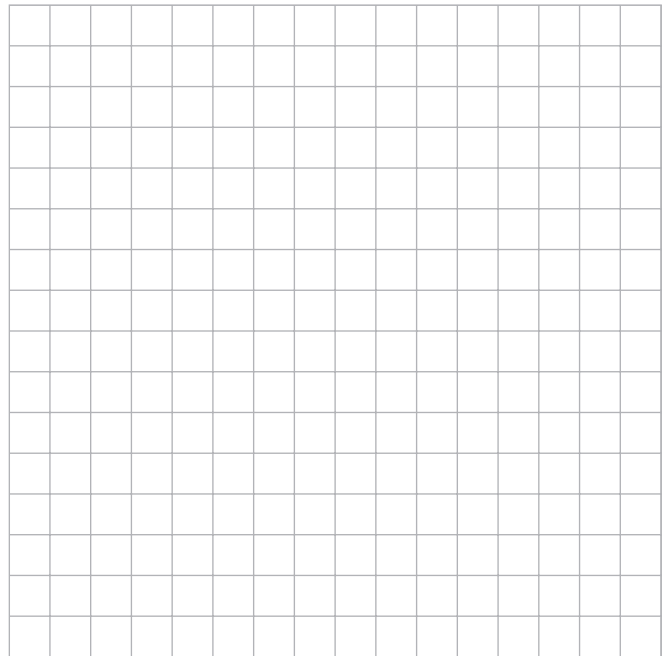
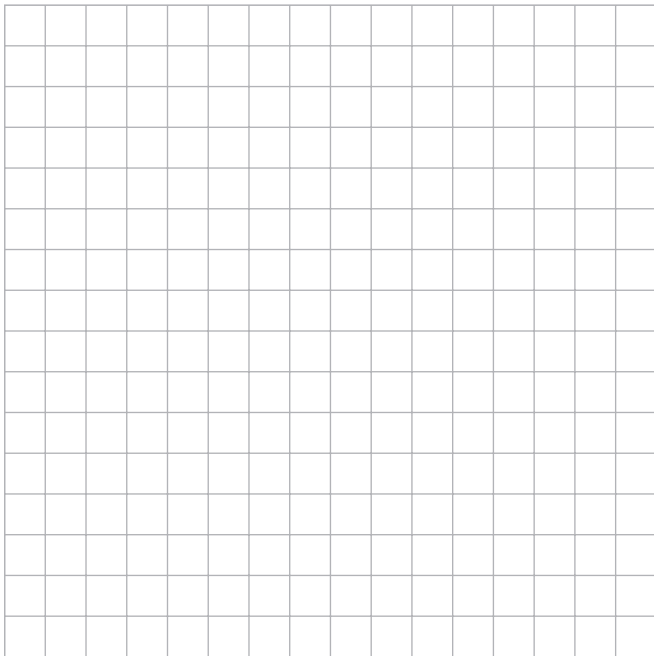
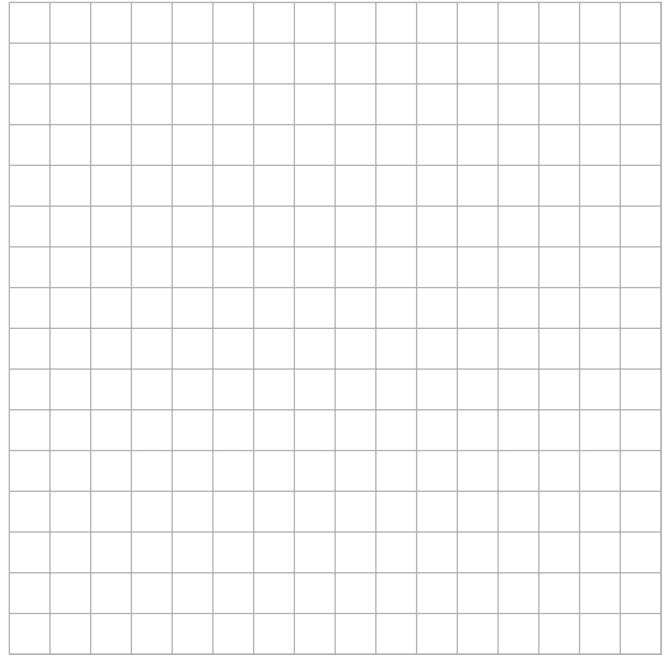
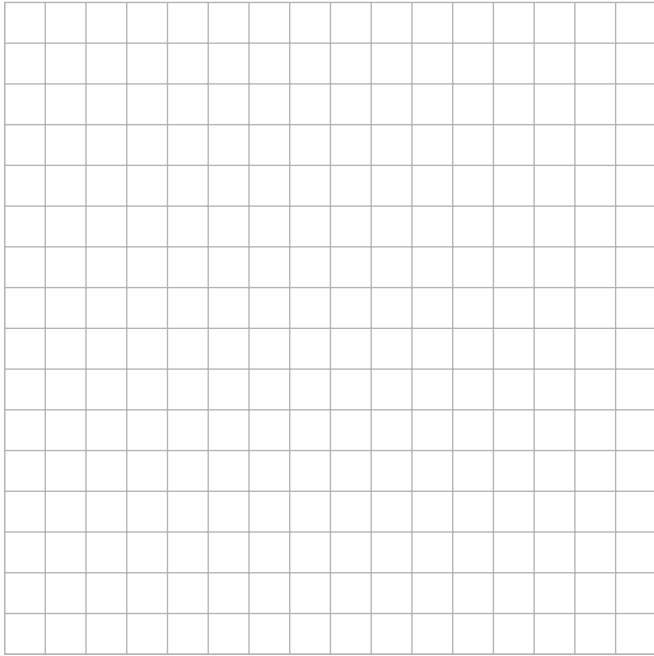
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$$F_z(z) = P[Z \leq z]$$

$z$	<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

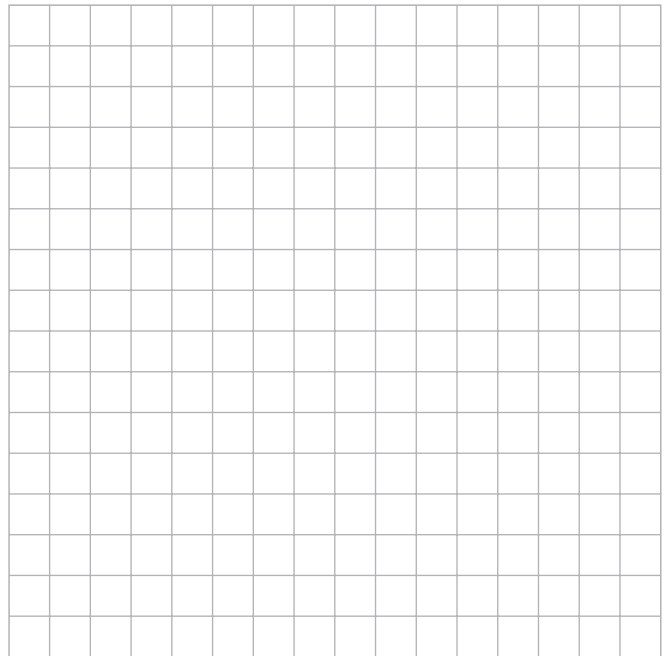
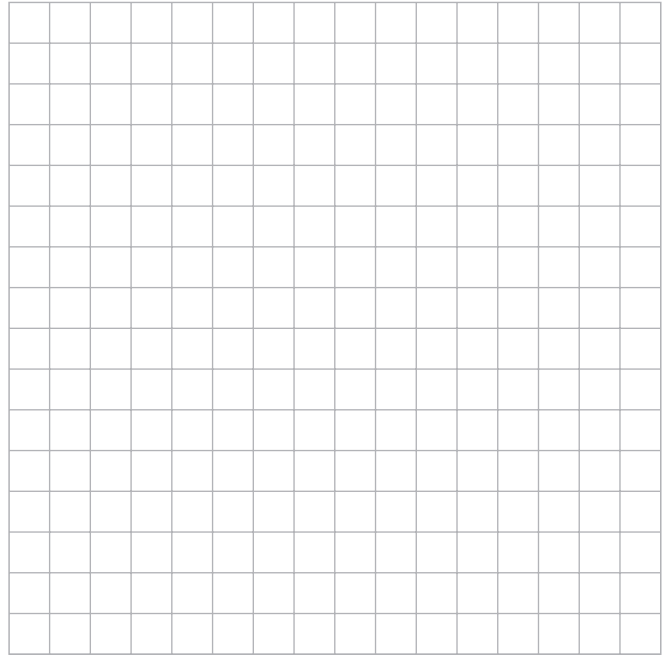
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# ROUGH WORK FOR GRAPHING

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