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Principles of Mathematics 12

APRIL 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 6b:

8.  .

(2)

Question 1b:

2.  .

(2)

Question 7a:

9.  .

(3)

Question 2:

3.  .

(4)

Question 7b:

10.  .

(1)

Question 3:

4.  .

(5)

Question 8:

11.  .

(5)

Question 4:

5.  .

(4)

Question 5:

6.  .

(4)

Question 6a:

7.  .

(2)

# **PRINCIPLES OF MATHEMATICS 12**

**April 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. Give the exact value of  $\cos \frac{11\pi}{6}$ .

A.  $-\frac{\sqrt{3}}{2}$

B.  $-\frac{\sqrt{2}}{2}$

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

D.  $\frac{\sqrt{3}}{2}$

2. Simplify:  $\frac{2 \sin \theta}{\sin 2\theta}$

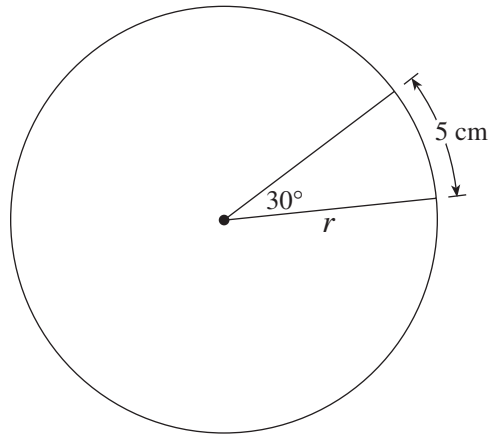
A. 1

B.  $\cos \theta$

C.  $\csc \theta$

D.  $\sec \theta$

3. An arc of length 5 cm subtends an angle of  $30^\circ$  at the centre of a circle with radius  $r$ , as shown in the diagram. Determine the value of  $r$ .



- A. 4.77  
B. 6.00  
C. 9.55  
D. 10.00
4. Determine the period of  $y = \tan \pi x$ .
- A. 1  
B. 2  
C.  $\frac{\pi}{2}$   
D.  $\pi$
5. Solve:  $3 \sin x = x + 1$ ,  $0 \leq x < 2\pi$
- A. 0.25  
B. 1.87, 2.87  
C. 0.54, 1.54  
D. 0.54, 1.87



6. Simplify:  $\sin\left(\frac{3\pi}{2} + x\right)$

- A.  $\sin x$
- B.  $\cos x$
- C.  $-\sin x$
- D.  $-\cos x$

7. Solve:  $\sin^2 x = \sin x \cos x$ ,  $0 \leq x < 2\pi$

- A.  $x = 0, \frac{\pi}{4}$
- B.  $x = \frac{\pi}{4}, \frac{5\pi}{4}$
- C.  $x = 0, \frac{3\pi}{4}, \pi, \frac{7\pi}{4}$
- D.  $x = 0, \frac{\pi}{4}, \pi, \frac{5\pi}{4}$

8. The terminal arm of angle  $\theta$  in standard position passes through the point  $(-2, 5)$ . Determine the value of  $\sec \theta$ .

- A.  $-\frac{\sqrt{21}}{2}$
- B.  $\frac{\sqrt{21}}{5}$
- C.  $-\frac{\sqrt{29}}{2}$
- D.  $\frac{\sqrt{29}}{5}$

9. Determine the range of the function  $y = b \cos ax - 2b$ , where  $a > 0$ ,  $b > 0$ .

- A.  $b \leq y \leq 3b$
- B.  $-3b \leq y \leq -b$
- C.  $b - a \leq y \leq b + a$
- D.  $2b - a \leq y \leq 2b + a$

**OVER**

10. Determine the general solution for:  $\sin 2x = -\frac{1}{2}$

A.  $\frac{7\pi}{12} + 2n\pi, \frac{11\pi}{12} + 2n\pi$  ( $n$  is any integer)

B.  $\frac{7\pi}{12} + n\pi, \frac{11\pi}{12} + n\pi$  ( $n$  is any integer)

C.  $\frac{13\pi}{12} + 2n\pi, \frac{21\pi}{12} + 2n\pi$  ( $n$  is any integer)

D.  $\frac{13\pi}{12} + n\pi, \frac{21\pi}{12} + n\pi$  ( $n$  is any integer)

11. Calculate the 10<sup>th</sup> term of the geometric sequence: 2, 6, 18, 54, ...

A. 1 536

B. 3 072

C. 39 366

D. 118 098

12. Evaluate:  $\sum_{k=4}^9 5(2)^k$

A. 2 480

B. 2 555

C. 5 040

D. 5 110

13. Lana invests in a bond which pays interest at the rate of 2.5% per year compounded annually. After 10 years the value of the bond has increased to \$1 267.28. What was the original value of the bond? (Accurate to the nearest cent.)

A. \$136.07

B. \$170.09

C. \$990.00

D. \$1 014.75

14. The second term of a geometric series is  $-16$  and the seventh term is  $512$ . Determine the first term.

- A.  $-2$
- B.  $2$
- C.  $-8$
- D.  $8$

15. Determine an expression for the sum of the infinite geometric series:

$$a - 1 + \frac{1}{a} - \frac{1}{a^2} + \dots, \text{ where } a > 1$$

- A.  $\frac{a^2}{a+1}$
- B.  $a+1$
- C.  $\frac{a^2}{a-1}$
- D.  $a-1$

16. Determine an equivalent expression for  $\log P - \log Q$ .

- A.  $\log(P - Q)$
- B.  $\log PQ$
- C.  $\log \frac{P}{Q}$
- D.  $\frac{\log P}{\log Q}$

17. Determine an equation of the asymptote of  $y = 2 \log_3(x + 4) - 5$ .

- A.  $x = -5$
- B.  $x = -4$
- C.  $y = -5$
- D.  $y = -4$

**OVER**

18. Solve:  $\log_5(x - 3) = 2$

- A. 5
- B. 13
- C. 28
- D. 35

19. Atmospheric pressure varies with altitude above the surface of the earth. For altitudes up to 10 km, the pressure,  $p$ , in kilopascals, is given by  $p = 100e^{-0.139a}$ , where  $a$  is the altitude in km. What would the pressure be at 5 km above the surface of the earth? (Answer to the nearest kilopascal.)

- A. 22
- B. 50
- C. 93
- D. 200

20. Solve for  $x$ :  $(\sqrt{a})^{6x-2} = (a^2)^{2x+3}$

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

21. The half-life of Iodine-126 is 13 days. Calculate the length of time, in days, that it will take for 100 g of Iodine-126 to decay to 15 g.

- A. 4.75
- B. 9.00
- C. 34.43
- D. 35.58

22. If  $\log c = 3$ , evaluate  $\log 10c^2$ .

- A. 6
- B. 7
- C. 8
- D. 10

23. If  $x$  is an angle in standard position, in which quadrants is the expression  $\log(\cos x)$  defined?
- A. Quadrant 1, Quadrant 2
  - B. Quadrant 1, Quadrant 4
  - C. Quadrant 2, Quadrant 3
  - D. Quadrant 3, Quadrant 4
24. Determine the length of the minor axis of the ellipse  $\frac{x^2}{25} + \frac{y^2}{9} = 1$ .
- A. 3
  - B. 5
  - C. 6
  - D. 10
25. Determine an equation of the circle with centre  $(0, 0)$  that passes through the point  $(3, 4)$ .
- A.  $x^2 + y^2 = 5$
  - B.  $x^2 + y^2 = 9$
  - C.  $x^2 + y^2 = 16$
  - D.  $x^2 + y^2 = 25$
26. Change to standard form:  $x^2 - y^2 - 2y = 0$
- A.  $x^2 - (y - 1)^2 = 1$
  - B.  $x^2 - (y + 1)^2 = 1$
  - C.  $x^2 - (y - 1)^2 = -1$
  - D.  $x^2 - (y + 1)^2 = -1$

27. Determine the restrictions on the constants  $A$ ,  $C$  and  $D$  so that  $Ax^2 + Cy^2 + Dx + Ey + F = 0$  represents a parabola that opens to the left.

- A.  $A \neq 0$ ,  $CD < 0$
- B.  $A \neq 0$ ,  $CD > 0$
- C.  $A = 0$ ,  $CD < 0$
- D.  $A = 0$ ,  $CD > 0$

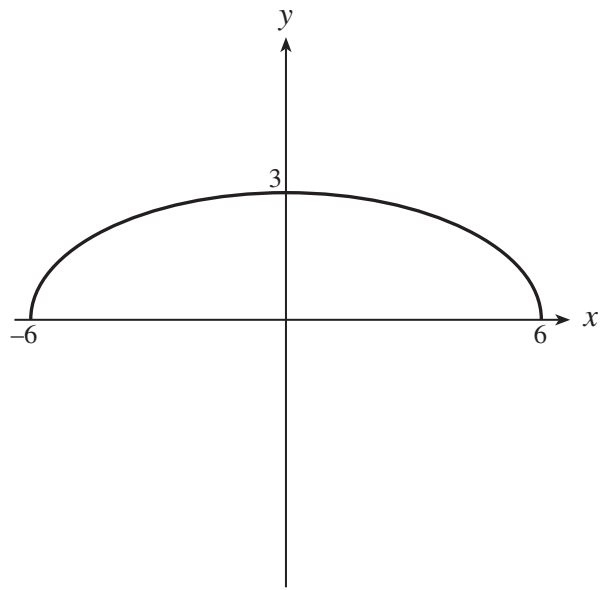
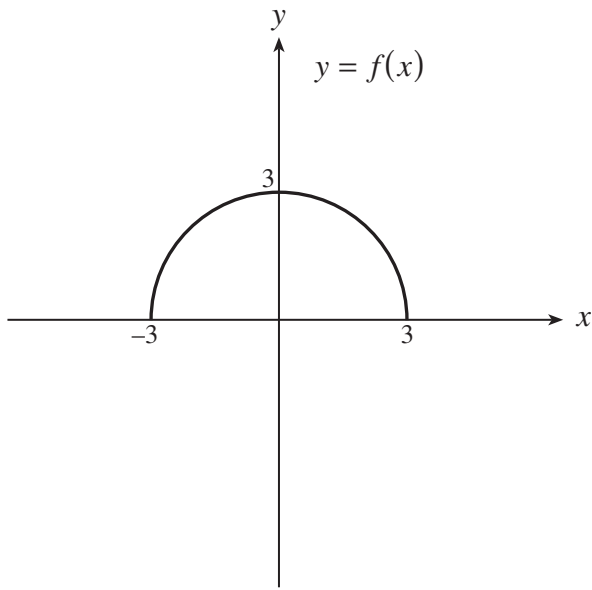
28. Which equation represents the graph of  $y = f(x)$  after it is reflected in the  $x$ -axis?

- A.  $y = f(-x)$
- B.  $y = -f(x)$
- C.  $x = f(y)$
- D.  $y = |f(x)|$

29. If  $f(x) = \frac{2x}{x-1}$ , determine the equation of  $f^{-1}(x)$ , the inverse of  $f(x)$ .

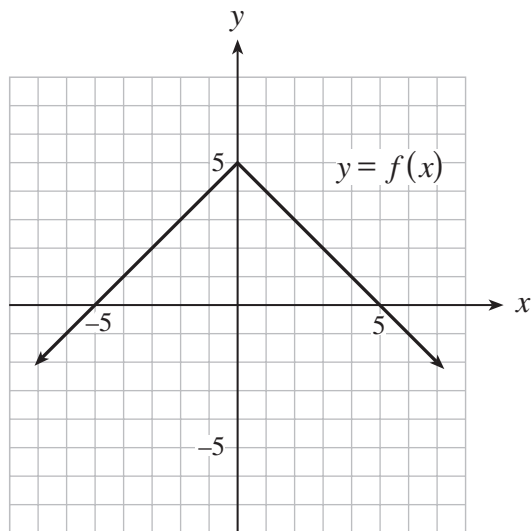
- A.  $f^{-1}(x) = \frac{x}{x-2}$
- B.  $f^{-1}(x) = \frac{2x}{2x-1}$
- C.  $f^{-1}(x) = \frac{x-1}{2x}$
- D.  $f^{-1}(x) = \frac{1}{x-2}$

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

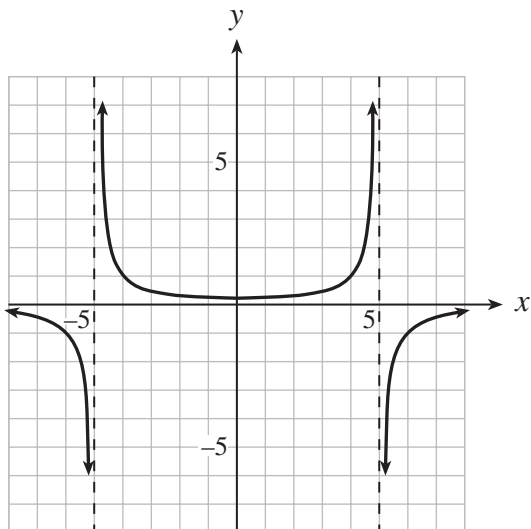


- A.  $y = f\left(\frac{1}{2}x\right)$
- B.  $y = f(2x)$
- C.  $y = \frac{1}{2}f(x)$
- D.  $y = 2f(x)$

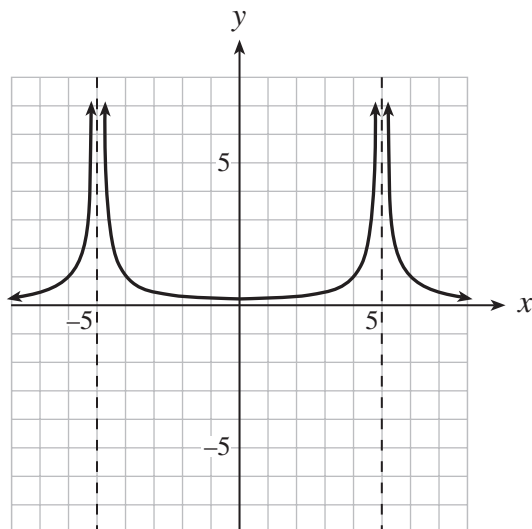
31. Given the graph of  $y = f(x)$ , which of the following best represents the graph of its reciprocal function?



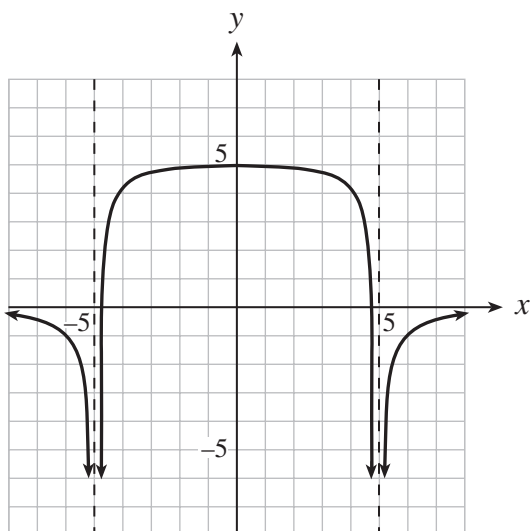
A.



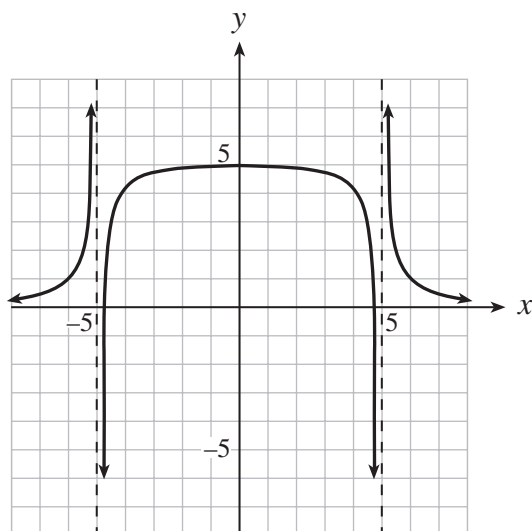
B.



C.



D.





32. If the range of  $y = f(x)$  is  $-3 \leq y \leq 5$ , what is the range of  $y = |f(x)|$  ?
- A.  $-3 \leq y \leq 5$
  - B.  $0 \leq y \leq 3$
  - C.  $0 \leq y \leq 5$
  - D.  $3 \leq y \leq 5$
33. The point  $(-2, 6)$  is on the graph of  $y = f(x)$ . Which of the following points must be on the graph of  $y = \frac{1}{3}f(2(x-1))$  ?
- A.  $(0, 2)$
  - B.  $(-6, 2)$
  - C.  $(-3, 18)$
  - D.  $(-5, 18)$
34. When playing the 6/49 lottery, a customer must choose 6 different numbers from 1 to 49 inclusive. How many combinations are possible?
- A.  $49!$
  - B.  $\frac{49!}{6!43!}$
  - C.  $\frac{49!}{43!}$
  - D.  $\frac{49!}{6!}$
35. Twelve buttons differ only by colour. There are 4 red buttons, 4 green buttons and 4 yellow buttons. If the buttons are placed in a row, how many different arrangements are possible?
- A. 11 880
  - B. 34 650
  - C. 19 958 400
  - D. 479 001 600

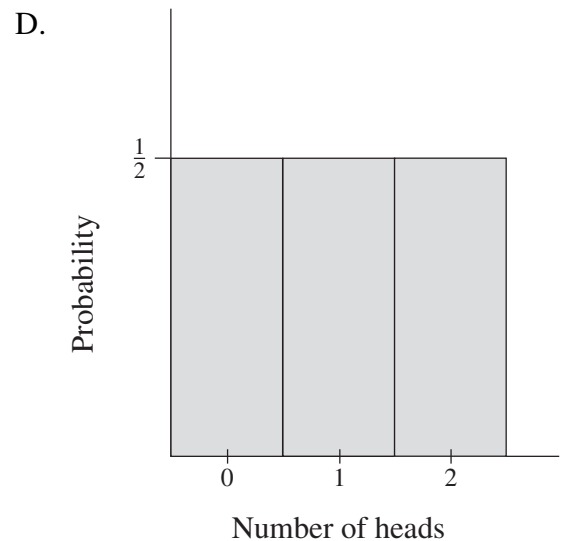
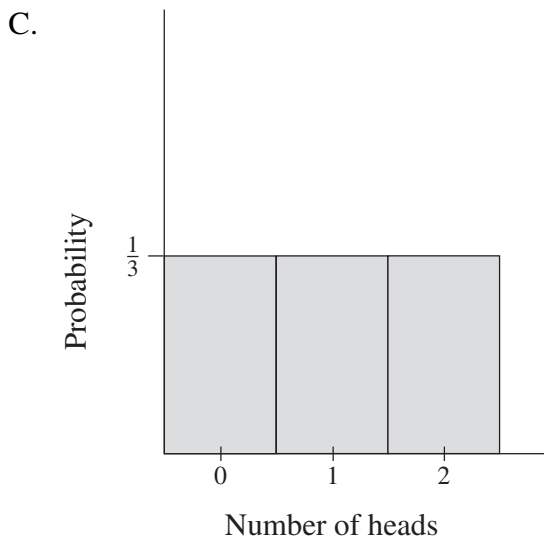
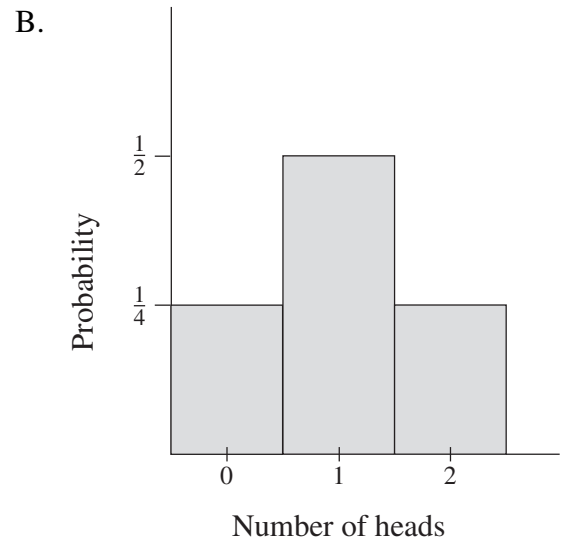
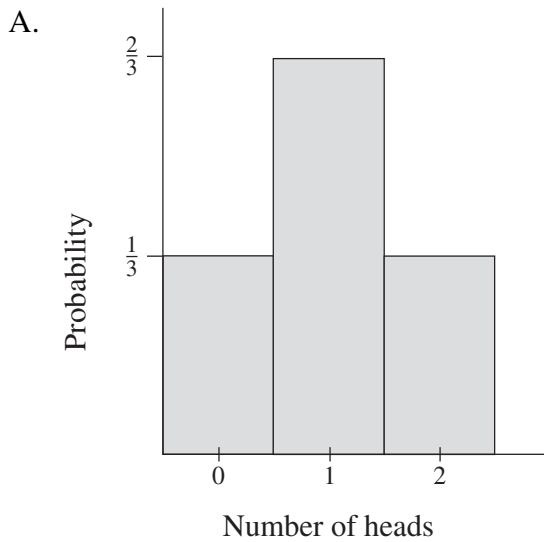
**OVER**

36. How many odd 3-digit whole numbers are there? For example, 203 is acceptable but 023 is not.
- A. 360
  - B. 450
  - C. 500
  - D. 900
37. An experiment consists of tossing a fair coin and rolling a fair die. What is the probability of obtaining a head and a 5?
- A.  $\frac{1}{12}$
  - B.  $\frac{1}{10}$
  - C.  $\frac{7}{12}$
  - D.  $\frac{2}{3}$
38. A multiple-choice test has 10 questions. Each question has 4 choices, only one of which is correct. If a student answers each question by guessing randomly, which expression below gives the probability that the student gets exactly 7 questions correct?
- A.  $\frac{{}_7C_4({}_3C_3)}{{}_{10}C_7}$
  - B.  $\frac{{}_4C_1({}_4C_3)}{{}_{10}C_4}$
  - C.  ${}_{10}C_7\left(\frac{1}{2}\right)^7\left(\frac{1}{2}\right)^3$
  - D.  ${}_{10}C_7\left(\frac{1}{4}\right)^7\left(\frac{3}{4}\right)^3$
39. Six people are randomly selected from a group of 8 males and 10 females to form a committee. Determine the probability that exactly 4 males are selected for this committee.
- A. 0.01
  - B. 0.10
  - C. 0.17
  - D. 0.32

40. Two cards are drawn without replacement from a standard deck of 52 cards. What is the probability that the first card is a face card and the second card is a queen?

- A.  $\frac{11}{663}$
- B.  $\frac{3}{169}$
- C.  $\frac{3}{221}$
- D.  $\frac{4}{221}$

41. Which of the following represents the binomial probability distribution of the number of heads obtained when a fair coin is tossed 2 times?



42. For a standard normal distribution, determine the probability that a  $z$ -score is greater than 1.0.

- A. 0.1587
- B. 0.3173
- C. 0.6827
- D. 0.8413

43. During a summer season, a golfer plays 30 rounds with scores as shown in the table below. Calculate the mean and the standard deviation of the population of scores.

Score	Number of rounds
79	2
80	4
81	6
82	8
83	10

- A. 81.00, 1.41
- B. 81.00, 6.00
- C. 81.67, 1.41
- D. 81.67, 1.25

44. It is estimated that 15% of the Canadian population watches at least one hockey game on television per week. If the **normal approximation to the binomial** is used, which of the following gives the best approximation for the probability that 100 or more people from 600 randomly chosen Canadians watched at least one hockey game per week?

- A.  $P(Z \geq 1.03)$
- B.  $P(Z \geq 1.06)$
- C.  $P(Z \geq 1.09)$
- D.  $P(Z \geq 1.14)$

**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

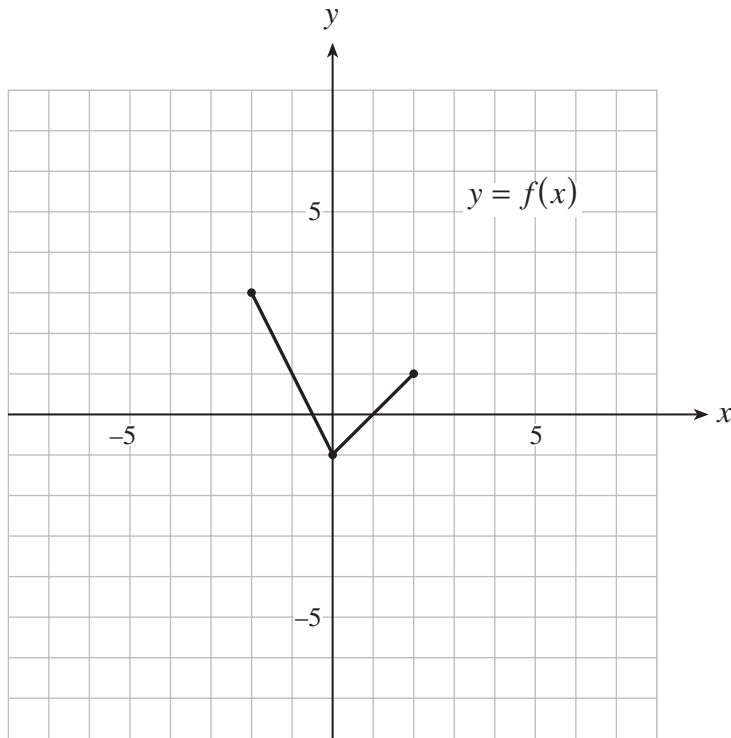
**INSTRUCTIONS:** Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question. Where required, place the final answer for each question in the space provided.

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.

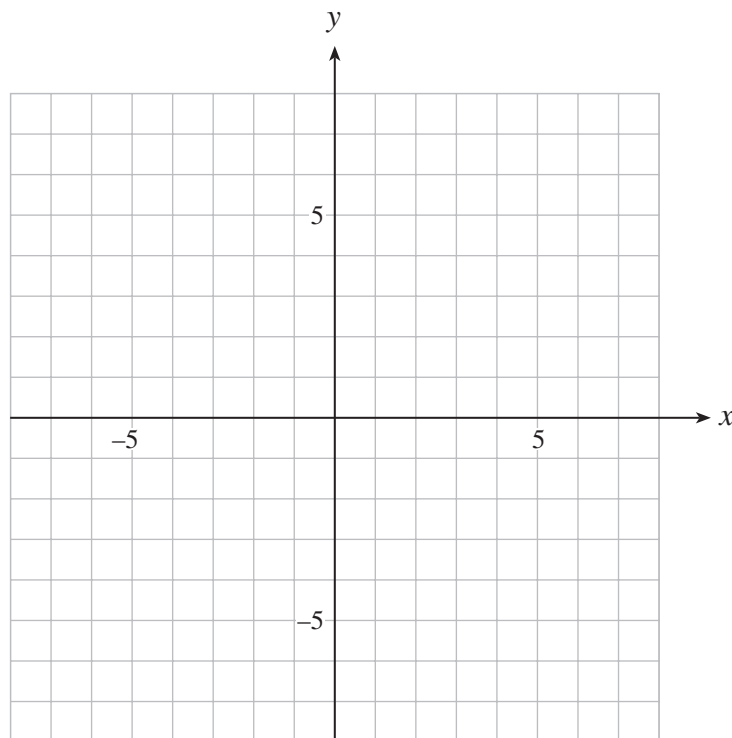
**Full marks will NOT be given for the final answer only.**

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



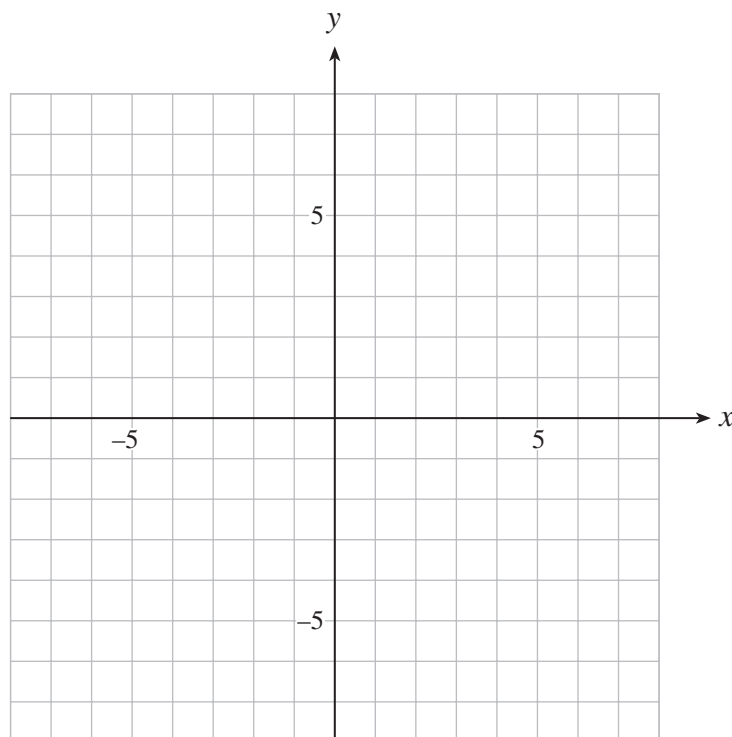
a) On the grid provided, sketch the graph of  $y = f(x + 2) - 3$ .

(2 marks)

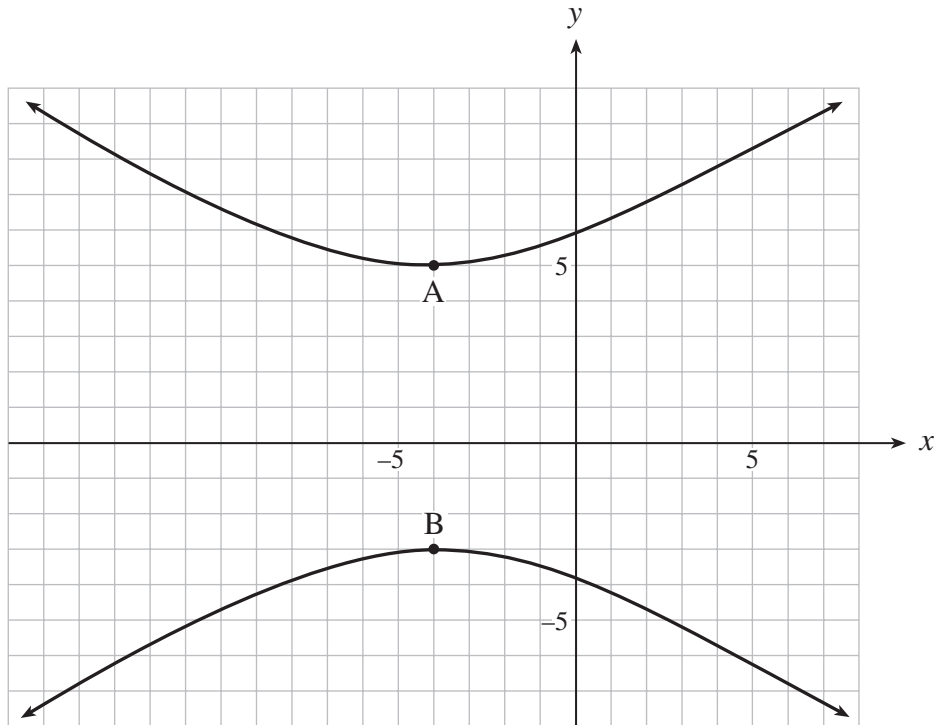


b) On the grid provided, sketch the graph of  $y = 2f(-x)$ .

(2 marks)



2. Determine an equation of the hyperbola graphed below if the slopes of the asymptotes are  $\pm \frac{2}{3}$  and the vertices are points A and B. (4 marks)





ANSWER:

3. Solve algebraically:  $\log_2 x = 3 - \log_2(x + 2)$

**(5 marks)**

ANSWER:

4. Determine the first 3 terms of the expansion:  $(x - 2y)^7$

**(4 marks)**

ANSWER:

**OVER**

5. A building supply store buys 40% of its pine boards from sawmill A and 60% from sawmill B. Due to pine beetle infestation, 7% of the boards from sawmill A and 5% from sawmill B have a blue discoloration. If a randomly picked board is discoloured, what is the probability that it came from sawmill A? **(4 marks)**

ANSWER:

6. The masses of bags of tortilla chips produced in a factory are normally distributed with a mean mass of 340 g and a standard deviation of 5 g.

a) What proportion of the bags will contain between 334 g and 347 g?

**(2 marks)**

ANSWER:



- b) The factory has an acceptable minimum mass per bag. All bags with a smaller mass are rejected. If 8% of the bags are rejected, calculate the acceptable minimum mass. **(2 marks)**

ANSWER:

**OVER**

7. A Ferris wheel has a radius of 25 m and its centre is 27 m above the ground. It rotates once every 40 seconds. Sandy gets on the Ferris wheel at its lowest point and then the wheel starts to rotate.
- a) Determine a sinusoidal equation that gives Sandy's height,  $h$ , above the ground as a function of the elapsed time,  $t$ , where  $h$  is in metres and  $t$  is in seconds. **(3 marks)**

ANSWER:

b) Determine the first time,  $t$  (in seconds), when Sandy will be 35 m above the ground. **(1 mark)**

ANSWER:

**OVER**

8. Prove the identity:

(5 marks)

$$\frac{\sin x}{1 - \sin x} - \frac{\sin x}{1 + \sin x} = 2 \tan^2 x$$

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:

$$t_n = ar^{n-1}$$

$$S_n = \frac{a(1-r^n)}{1-r}$$

$$S_n = \frac{a-r\ell}{1-r}$$

$$S = \frac{a}{1-r}$$

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

### 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.

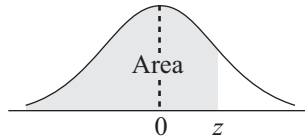
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# THE STANDARD NORMAL DISTRIBUTION TABLE



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

$z$	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

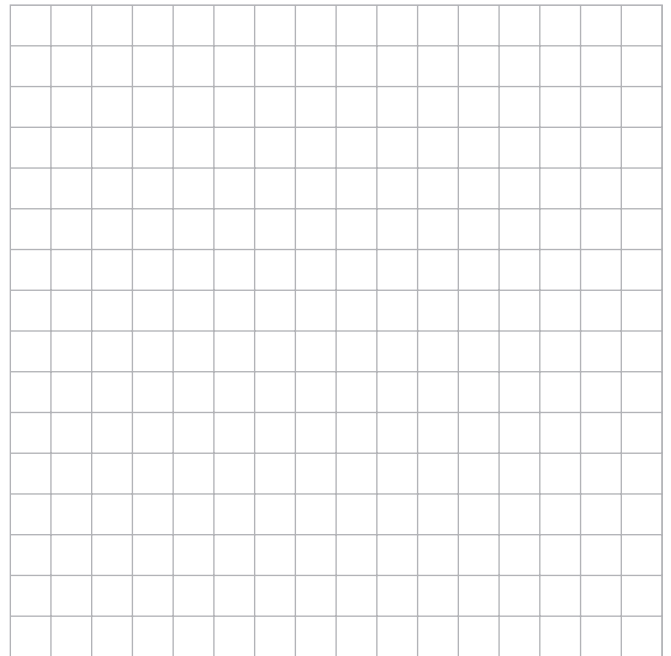
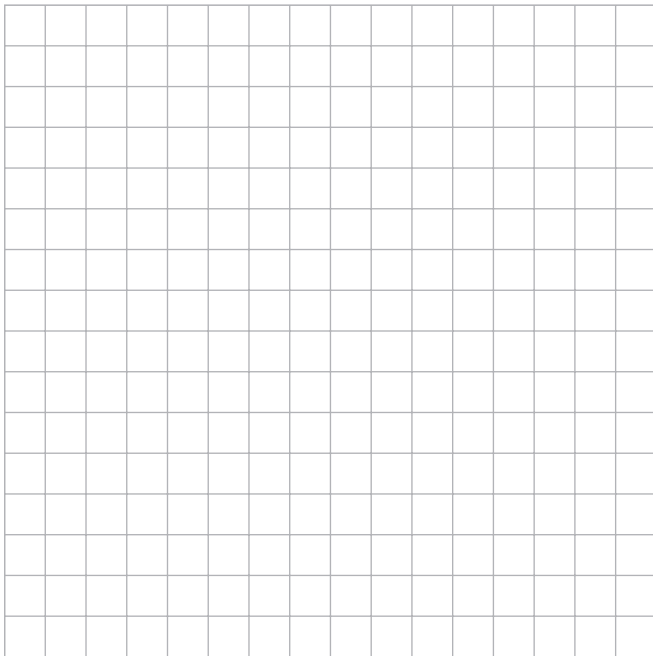
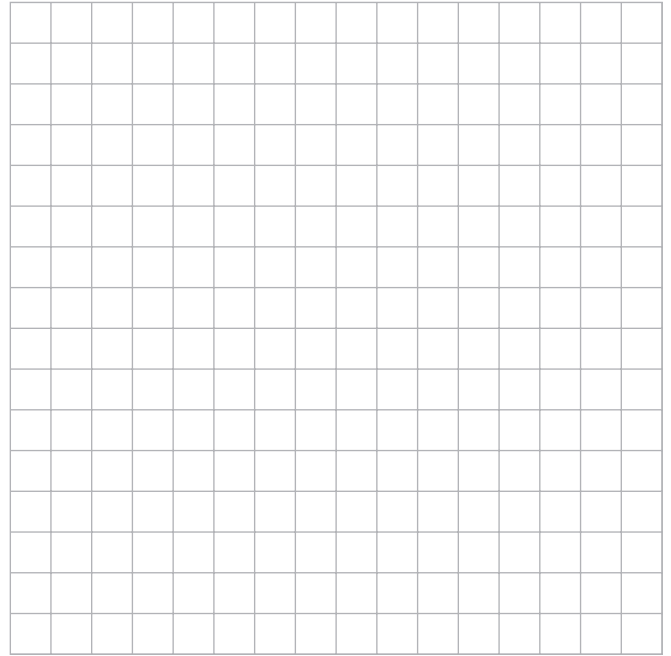
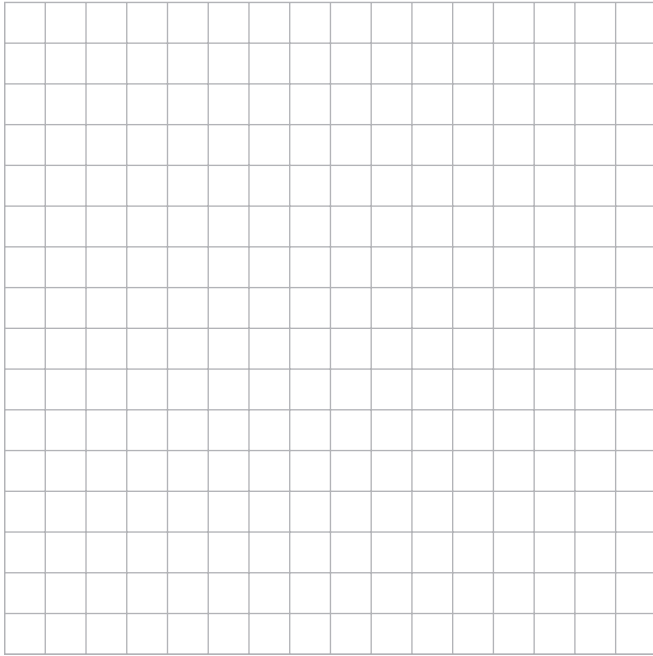
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$$F_z(z) = P[Z \leq z]$$

$z$	<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

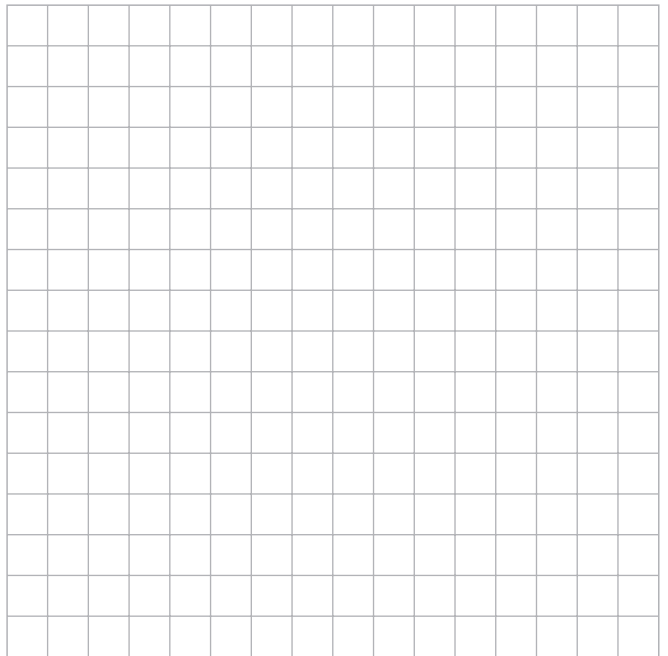
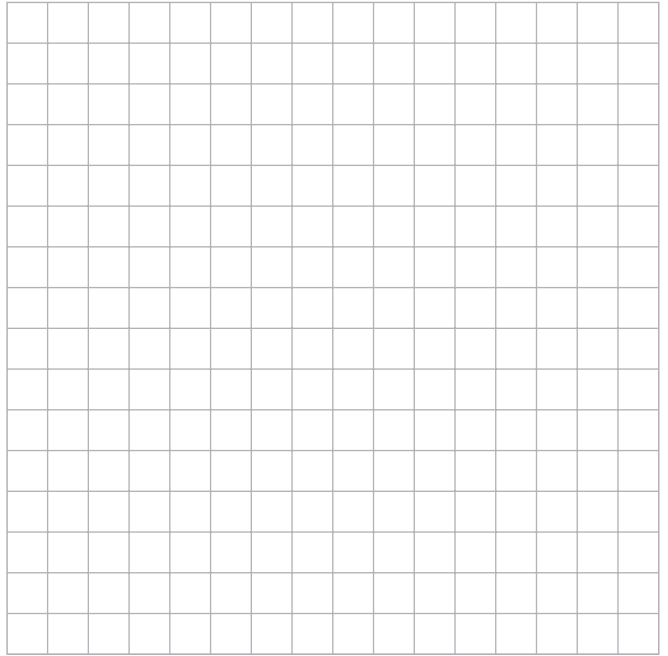
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# ROUGH WORK FOR GRAPHING

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**ROUGH WORK FOR MULTIPLE-CHOICE**

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