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Principles of Mathematics 12

January 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 5a:

7. .

(2)

Question 1b:

2. .

(2)

Question 5b:

8. .

(2)

Question 2:

3. .

(4)

Question 6a:

9. .

(2)

Question 3:

4. .

(5)

Question 6b:

10. .

(2)

Question 4a:

5. .

(2)

Question 7:

11. .

(4)

Question 4b:

6. .

(2)

Question 8:

12. .

(5)

PRINCIPLES OF MATHEMATICS 12

January 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 two parts: | | |
| PART A: 44 multiple-choice questions | 66 | 75 |
| PART B: 8 written-response questions | 34 | 45 |
| | Total: 100 marks | 120 minutes |
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.

- Convert $\frac{5\pi}{2}$ radians to degrees.
 - 90°
 - 180°
 - 270°
 - 450°

- Determine the range of the function $y = 4 \cos x - 2$.
 - $-4 \leq y \leq 4$
 - $-2 \leq y \leq 6$
 - $-6 \leq y \leq 2$
 - $2 \leq y \leq 6$

- Solve: $\sin 2x - \cos x = 1$, $0 \leq x < 2\pi$
 - 0, 5.07
 - 3.14, 4.32
 - 3.14, 4.36
 - 0.42, 1.89, 2.95, 4.21

- Determine the exact value of $\cot \frac{5\pi}{3}$.
 - $\sqrt{3}$
 - $-\sqrt{3}$
 - $\frac{1}{\sqrt{3}}$
 - $-\frac{1}{\sqrt{3}}$

OVER

5. Determine the period of the function $f(x) = -\frac{1}{2} \sin \frac{x}{3}$.

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

B. π

C. 4π

D. 6π

6. Solve: $2 \sin x + 1 = 0$, $0 \leq x < 2\pi$

A. $-\frac{\pi}{6}, -\frac{5\pi}{6}$

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

C. $\frac{7\pi}{6}, \frac{11\pi}{6}$

D. $\frac{4\pi}{3}, \frac{5\pi}{3}$

7. Determine an expression equivalent to $\frac{\tan \theta \csc^2 \theta}{\sec^2 \theta}$.

A. $\tan \theta$

B. $\cot \theta$

C. $\tan^2 \theta$

D. $\tan^3 \theta$

8. Simplify: $\cos(\pi - 2x)$

A. $-\cos 2x$

B. $-\sin 2x$

C. $\cos 2x$

D. $\sin 2x$

9. A wheel with radius 20 cm has its centre 30 cm above the ground. It rotates once every 15 seconds. Determine an equation for the height, h , above the ground of a point on the wheel at time t seconds if this point has a maximum height at $t = 2$ seconds.

A. $h = 20 \cos \frac{2\pi}{15}(t + 2) + 30$

B. $h = 20 \cos \frac{2\pi}{15}(t - 2) + 30$

C. $h = 30 \cos \frac{2\pi}{15}(t + 2) + 20$

D. $h = 30 \cos \frac{2\pi}{15}(t - 2) + 20$

10. Determine a cosine equation that has the following general solution: $\frac{\pi}{2} + n\pi$, $\frac{\pi}{6} + 2n\pi$, $\frac{11\pi}{6} + 2n\pi$, where n is an integer.

A. $\cos x(2 \cos x + \sqrt{2}) = 0$

B. $\cos x(2 \cos x + \sqrt{3}) = 0$

C. $\cos x(2 \cos x - \sqrt{2}) = 0$

D. $\cos x(2 \cos x - \sqrt{3}) = 0$

11. Determine the common ratio of the geometric sequence: $-64, 48, -36$

A. $-\frac{4}{3}$

B. $-\frac{3}{4}$

C. $\frac{3}{4}$

D. $\frac{4}{3}$

OVER

12. If the sum of n terms of the geometric sequence $4, 8, 16, \dots$ is $S_n = \frac{4(1-2^5)}{1-2}$, determine the value of n .
- A. 2
B. 4
C. 5
D. 6
13. In the geometric sequence $\frac{1}{8}, \frac{1}{2}, 2, \dots$, which term is 524 288?
- A. 11
B. 12
C. 13
D. 14
14. Determine the sum of the infinite geometric series: $\sum_{k=1}^{\infty} 200(0.6)^{k-1}$
- A. 125
B. 333
C. 500
D. no finite sum
15. If $x, 4, 8x$ are three consecutive terms in a geometric sequence, determine the values of x .
- A. ± 1
B. $\pm\sqrt{2}$
C. ± 2
D. $\pm 2\sqrt{2}$
16. Evaluate: $\log_{5.3} 210$
- A. 0.31
B. 1.60
C. 2.31
D. 3.21

17. Solve: $27^{x+2} = \left(\frac{1}{3}\right)^{3-6x}$

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

B. $\frac{1}{7}$

C. $\frac{5}{3}$

D. 3

18. Determine an equation of the asymptote of $f(x) = 2^{x-1} + 3$.

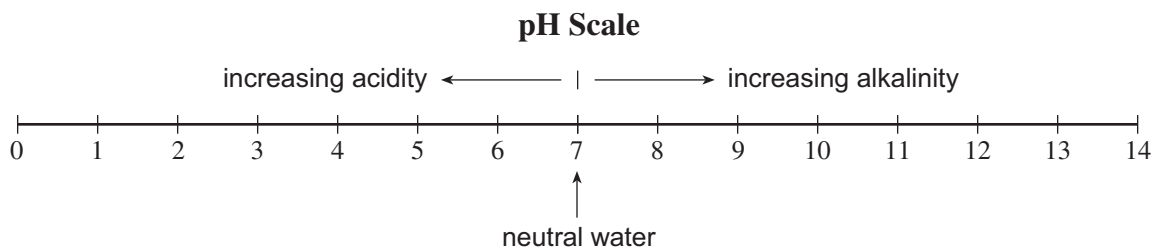
A. $y = 2$

B. $y = -2$

C. $y = 3$

D. $y = -3$

19. The pH scale measures the acidity (0–7) or alkalinity (7–14) of a solution. It is a logarithmic scale in base 10. Thus, a pH of 12 is 10 times more alkaline than a pH of 11. If bleach has a pH of 13, how many times more alkaline is it than blood which has a pH of 8?



A. 1.625

B. 5

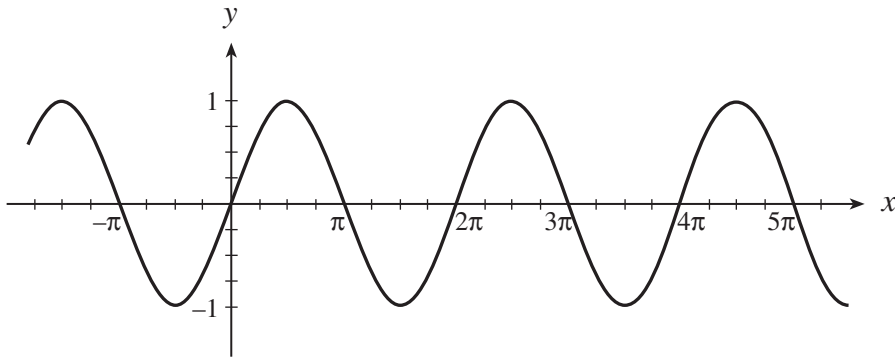
C. 50

D. 100 000

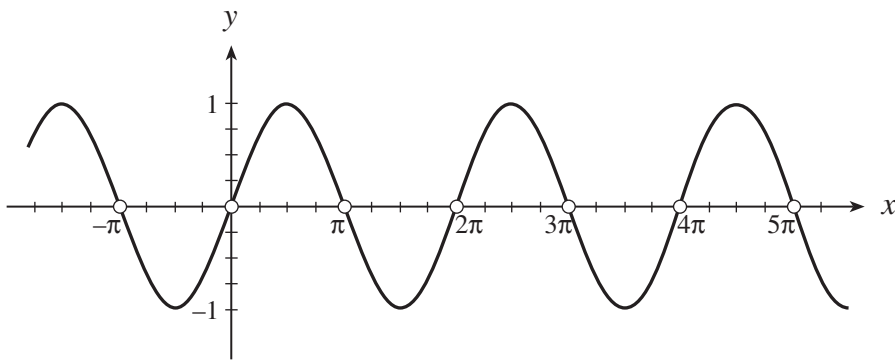
20. If $\log_3(m+n) = 2$, $(m+n) > 0$, express m in terms of n .
- A. $m = 9 - n$
 - B. $m = 6 - n$
 - C. $m = \frac{9}{n}$
 - D. $m = \frac{6}{n}$
21. If $B = \frac{A}{C^2}$, determine an expression for $\log B$.
- A. $\log A - 2 \log C$
 - B. $\log A - \log 2C$
 - C. $\frac{\log A}{2 \log C}$
 - D. $\frac{\log A - \log C}{2}$
22. A radioactive substance decays continuously according to the formula $N = Ce^{kt}$, where N is the final amount, C is the initial amount, k is a constant, and t is the time in years. If 50 grams of the substance decays to 20 grams in 10 years, determine the value of k .
- A. -0.0916
 - B. -0.0398
 - C. 0.0610
 - D. 0.0916

23. Which graph best represents the function $\log y = \log(\sin x)$?

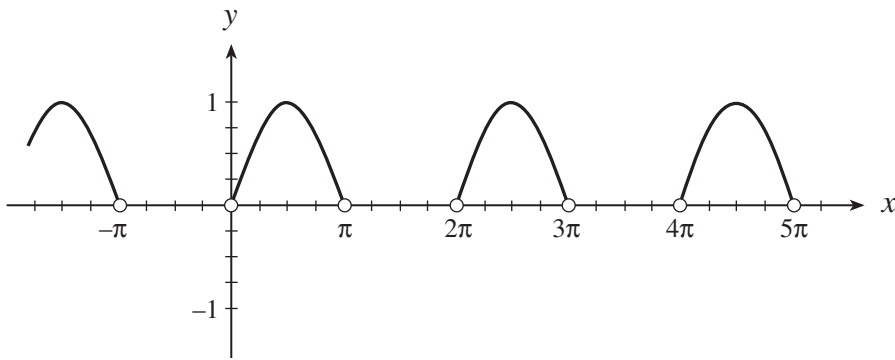
A.



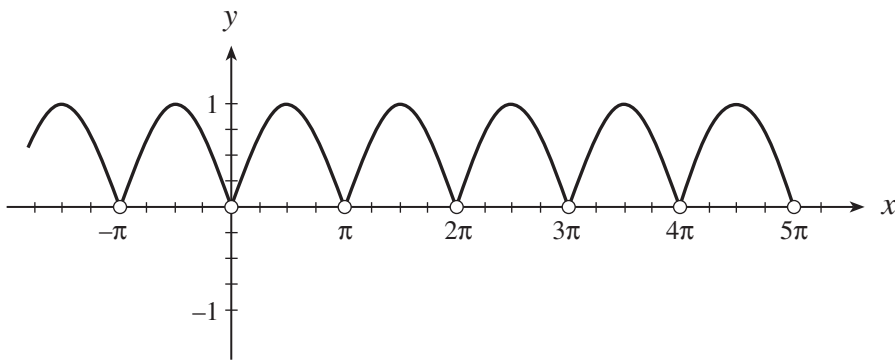
B.



C.



D.



OVER

24. Identify the conic: $8x^2 - 8y^2 + 4x - 4y - 32 = 0$

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

25. Determine an equation of the circle with centre $(-2, 5)$ and radius 4.

- A. $(x - 2)^2 + (y + 5)^2 = 4$
- B. $(x - 2)^2 + (y + 5)^2 = 16$
- C. $(x + 2)^2 + (y - 5)^2 = 4$
- D. $(x + 2)^2 + (y - 5)^2 = 16$

26. Determine an equation of the parabola with vertex $(3, -2)$ that passes through the point $(0, 1)$ and has a horizontal axis of symmetry.

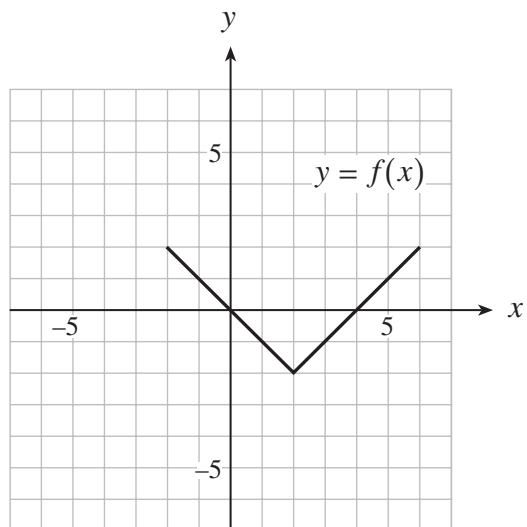
- A. $x = -\frac{1}{2}(y + 2)^2 + 3$
- B. $x = -\frac{1}{3}(y + 2)^2 + 3$
- C. $y = \frac{1}{3}(x - 3)^2 - 2$
- D. $y = \frac{1}{2}(x - 3)^2 - 2$

27. The equation $Ax^2 + Cy^2 + Dx + Ey - 1 = 0$ represents an ellipse (not a circle). If $A > 0$ and $C > 0$, what conditions must be satisfied if the ellipse has its major axis on the x -axis?

- A. $A < C, D = 0$
- B. $A < C, E = 0$
- C. $A > C, D = 0$
- D. $A > C, E = 0$

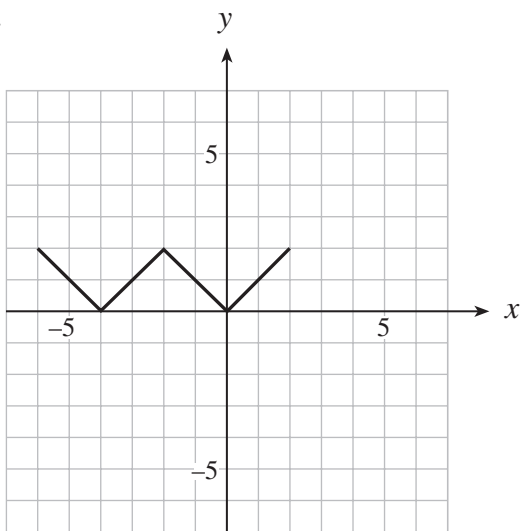
28. How is the graph of $y = f(x) + 3$ related to the graph of $y = f(x)$?
- A. $y = f(x)$ has been translated 3 units up.
 - B. $y = f(x)$ has been translated 3 units down.
 - C. $y = f(x)$ has been translated 3 units to the left.
 - D. $y = f(x)$ has been translated 3 units to the right.
29. Which equation represents the graph of $y = f(x)$ after it is reflected in the line $y = x$?
- A. $x = f(y)$
 - B. $y = f(-x)$
 - C. $y = -f(x)$
 - D. $y = \frac{1}{f(x)}$
30. If the graph of the function $y = \sqrt{x}$ is horizontally expanded by a factor of 3 and then translated 2 units to the right, determine the equation of this new function.
- A. $y = \sqrt{3(x-2)}$
 - B. $y = \sqrt{\frac{1}{3}(x-2)}$
 - C. $y = \sqrt{3x-2}$
 - D. $y = \sqrt{\frac{1}{3}x-2}$

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

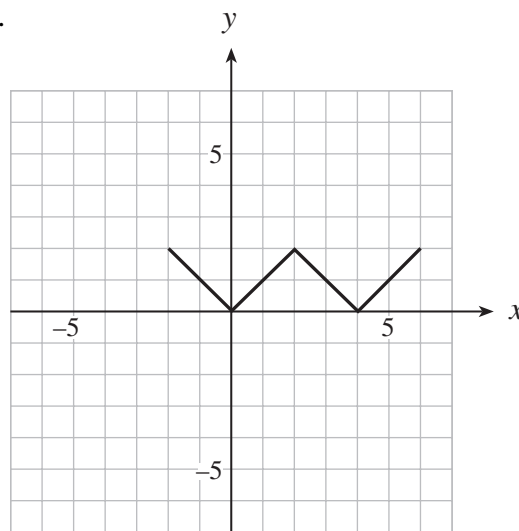


Which of the following is the graph of $y = |f(x)|$?

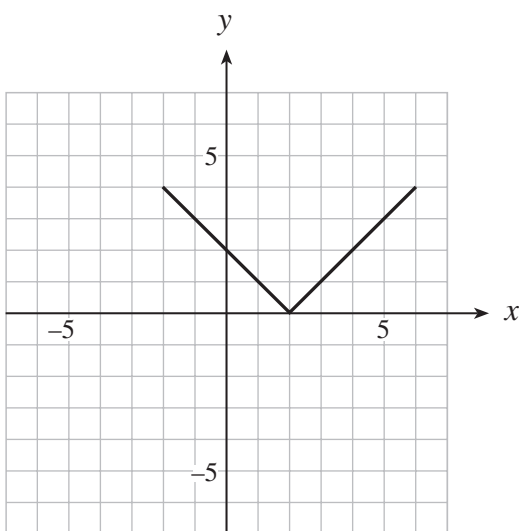
A.



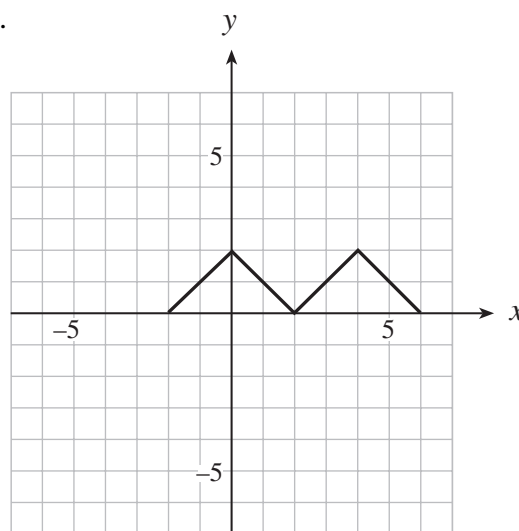
B.



C.

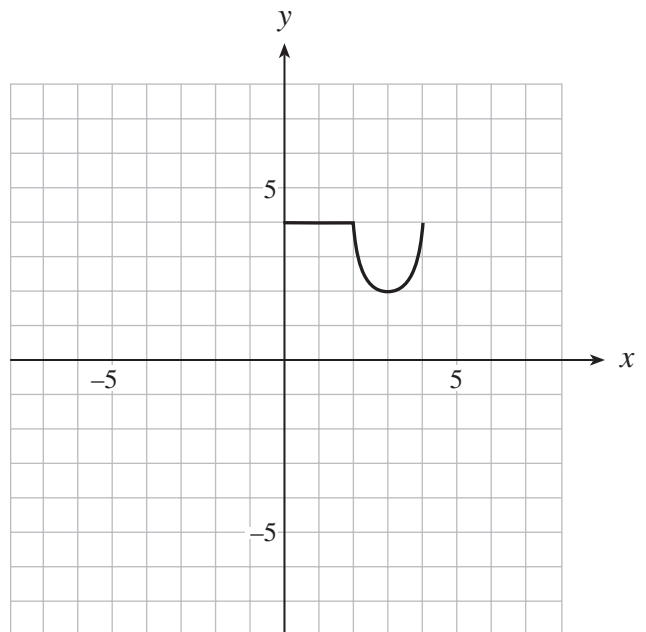
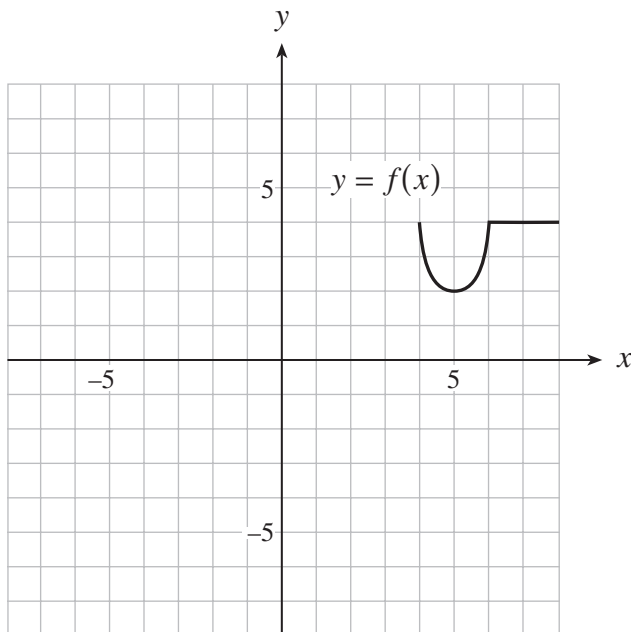


D.



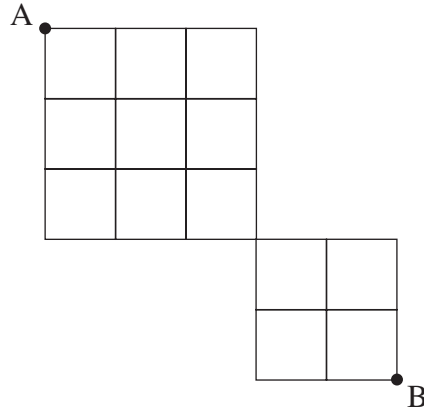
32. If $(8, -6)$ is a point on the graph of $y = f(x)$, what must be a point on the graph of $y = -f(2x) + 3$?
- A. $(-16, -3)$
 - B. $(-4, -3)$
 - C. $(4, 9)$
 - D. $(16, 9)$

33. The graph of $y = f(x)$ is shown below on the left. Which equation represents the graph shown on the right?



- A. $y = f(-(x+8))$
- B. $y = f(-(x-8))$
- C. $y = -f(x-8)$
- D. $y = -f(x+8)$

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



- A. 26
- B. 52
- C. 120
- D. 252

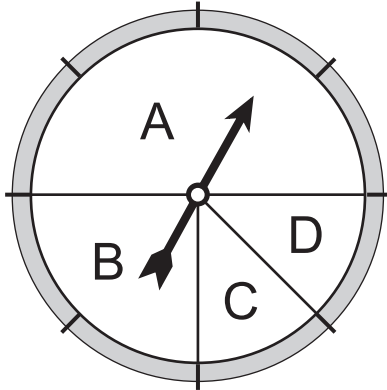
35. Simplify: $\frac{n(n+1)!}{(n-1)!}$

- A. $2n!$
- B. $n!(n^2 + n)$
- C. $2n$
- D. $n^3 + n^2$

36. In the expansion of $(2a - 3b)^6$, determine the coefficient of the term containing a^4b^2 .

- A. -4 320
- B. 864
- C. 2 160
- D. 2 880

37. When the pointer is spun, determine the probability that the pointer will stop on section C.



- A. $\frac{1}{8}$
B. $\frac{1}{4}$
C. $\frac{1}{3}$
D. $\frac{1}{2}$
38. In a group of 100 children, 35 children liked beans, 25 liked both beans and peas, and 5 liked neither beans nor peas. What is the probability that a randomly selected child from this group will like only peas?
- A. 0.1
B. 0.35
C. 0.45
D. 0.6
39. A golf putting machine is successful on 60% of its attempts at 4-metre putts. What is the probability that the machine will be successful on exactly eight of its next twelve 4-metre putts?
- A. 0.04
B. 0.06
C. 0.21
D. 0.77

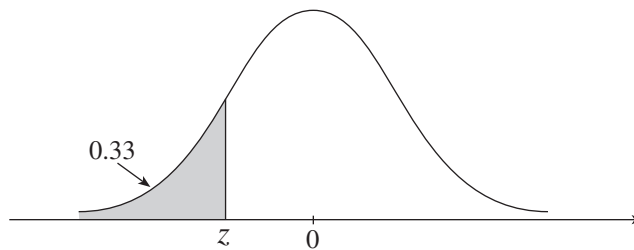
OVER

40. Three cards are dealt from a standard deck of 52 cards. Determine the probability of getting at least one diamond.
- A. 0.41
 - B. 0.44
 - C. 0.59
 - D. 0.75
41. In a population that has a normal distribution with mean μ and standard deviation σ , determine the approximate percentage of the population that lies between $\mu - 3\sigma$ and $\mu + 3\sigma$.
- A. 50%
 - B. 68%
 - C. 95%
 - D. 99.7%
42. Determine the mean and the standard deviation for the population of scores in the following frequency table.

Score	Frequency
4	6
5	3
7	8
9	2

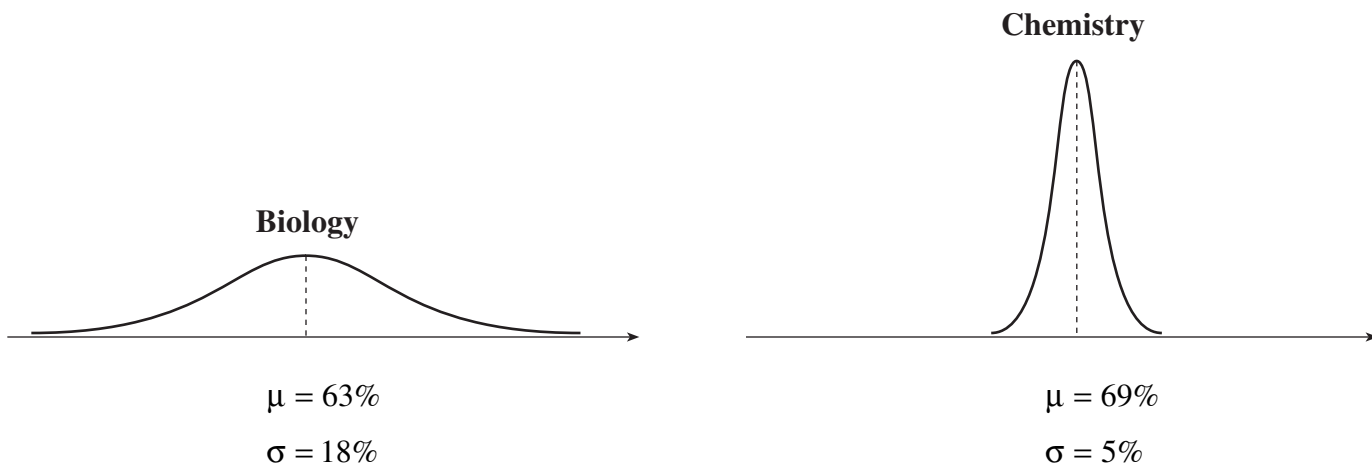
- A. $\mu = 5.95$, $\sigma = 1.67$
- B. $\mu = 5.95$, $\sigma = 2.55$
- C. $\mu = 4.52$, $\sigma = 2.55$
- D. $\mu = 6.25$, $\sigma = 1.92$

43. The shaded area under the standard normal curve shown is 0.33. Determine z .



- A. -0.44
- B. -0.17
- C. 0.17
- D. 0.44

44. The mark distributions of Biology and Chemistry students are given by the two normal curves below.



John has the same z -score standing in Biology and Chemistry. If his mark in Biology is 74%, what is his mark in Chemistry?

- A. 72%
- B. 73%
- C. 74%
- D. 75%

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

OVER

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PART B: WRITTEN RESPONSE

Value: 34 marks

Suggested Time: 45 minutes

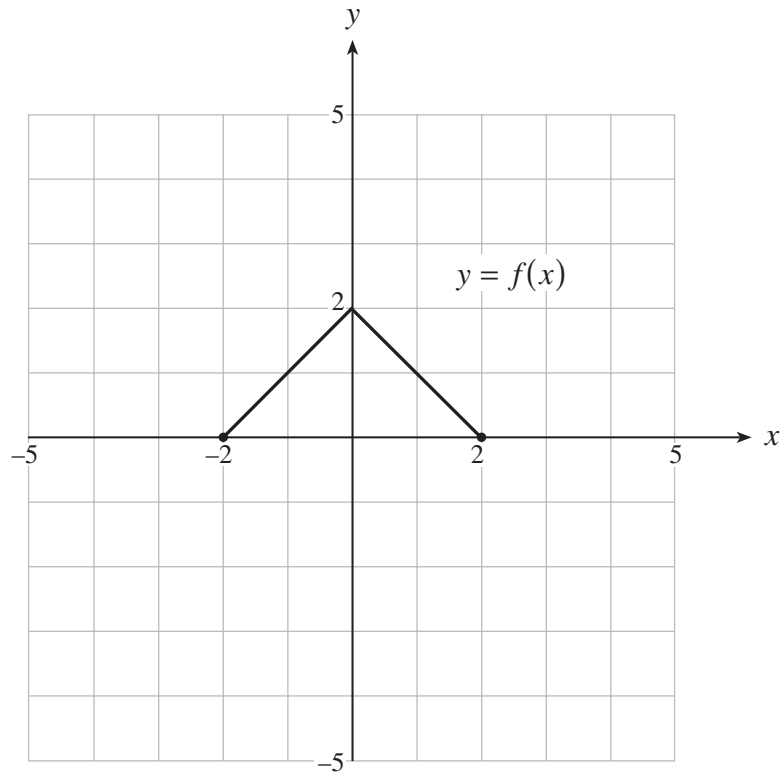
INSTRUCTIONS: Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question. Where required, place the final answer for each question in the space provided.

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.

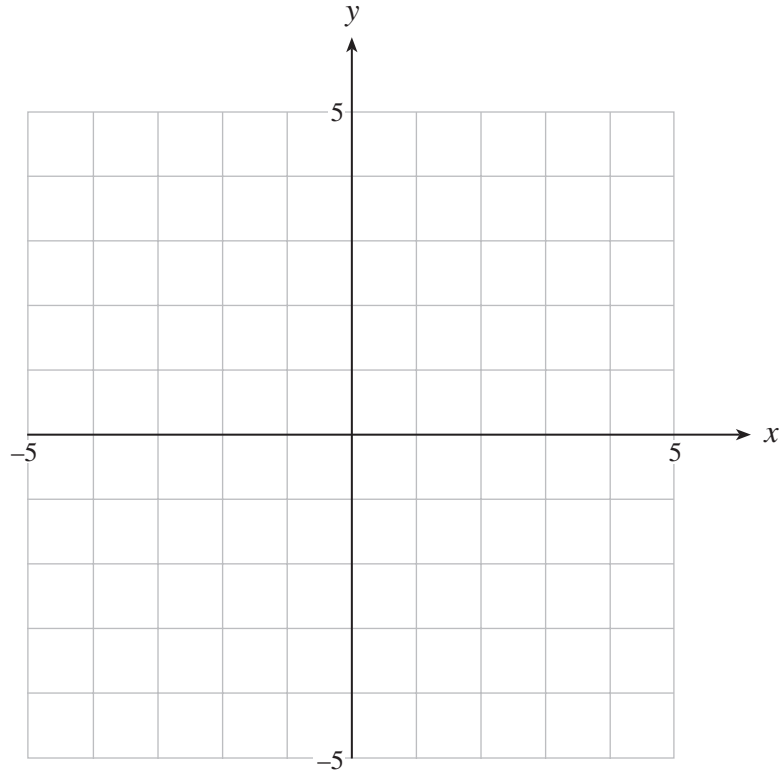
Full marks will NOT be given for the final answer only.

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



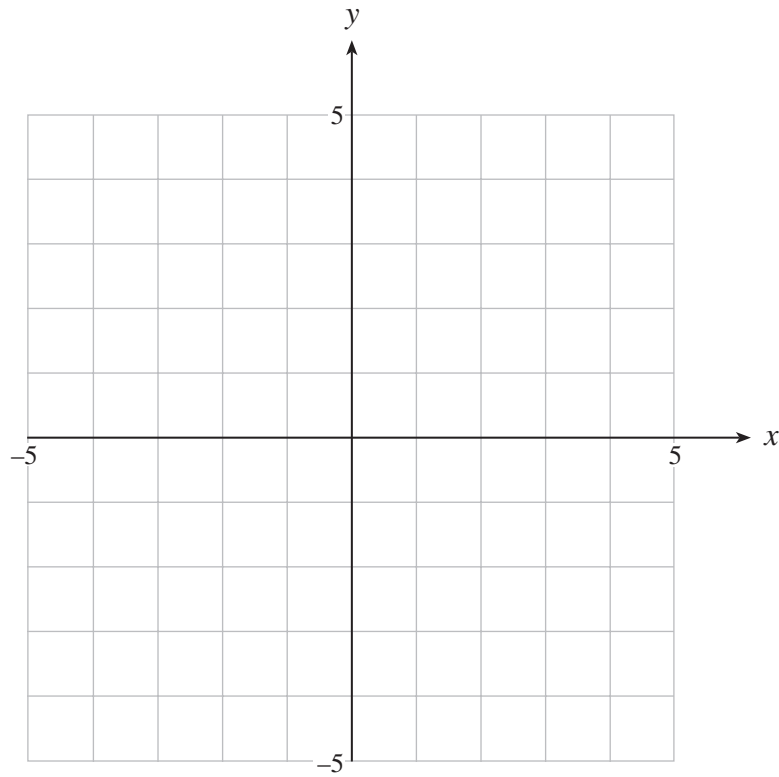
a) On the grid provided, sketch the graph of $y = 2f(x + 3)$.

(2 marks)



b) On the grid provided, sketch the graph of $y = \frac{1}{f(x)}$.

(2 marks)



OVER

2. Change to standard form.

(4 marks)

$$2y^2 + x + 12y + 23 = 0$$

ANSWER:

OVER

3. Solve algebraically: $2 \log(3 - x) = \log 4 + \log(6 - x)$

(5 marks)

ANSWER:

4. A toy box contains 4 different cars and 6 different trucks.

- a) In how many ways can a collection of 5 toys be chosen if the collection must consist of 2 cars and 3 trucks? **(2 marks)**

ANSWER:

- b) In how many ways can a collection of 5 toys be chosen if the collection must consist of at least 3 cars? **(2 marks)**

ANSWER:

OVER

5. Jar A contains 5 red balls and 7 white balls. Jar B contains 8 red balls and 4 white balls. A fair die is rolled. If a 1 or a 2 comes up, a ball is randomly selected from Jar A, otherwise, a ball is randomly selected from Jar B.
- a) Find the probability that a white ball is selected. **(2 marks)**

ANSWER:

b) Given that the ball selected is white, find the probability that it came from Jar A. (2 marks)

ANSWER:

OVER

6. The life expectancy of a car tire produced by a particular plant is normally distributed with a mean of 50 000 km and a standard deviation of 3 000 km.
- a) What percent of these tires lasts between 49 000 km and 52 000 km? **(2 marks)**

ANSWER:

- b) If the plant makes 80 000 tires, how many tires would be expected to last more than 55 000 km?
(Answer to the nearest tire.) **(2 marks)**

ANSWER:

OVER

7. Solve the following equation algebraically.

(4 marks)

$$3 \cos^2 x + \cos x - 2 = 0, \quad 0 \leq x < 2\pi$$

ANSWER:

8. Prove the identity:

(5 marks)

$$(\csc \theta - \sin \theta) \tan \theta = \frac{\sin 2\theta}{2 \sin \theta}$$

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:

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

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

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

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

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

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

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

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

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

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

$$\mu = np$$

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

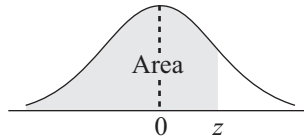
$$z = \frac{x - \mu}{\sigma}$$

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

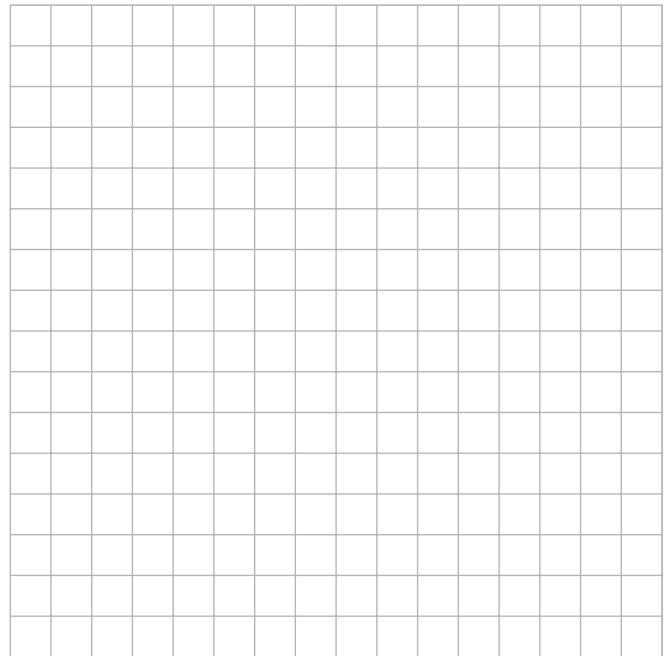
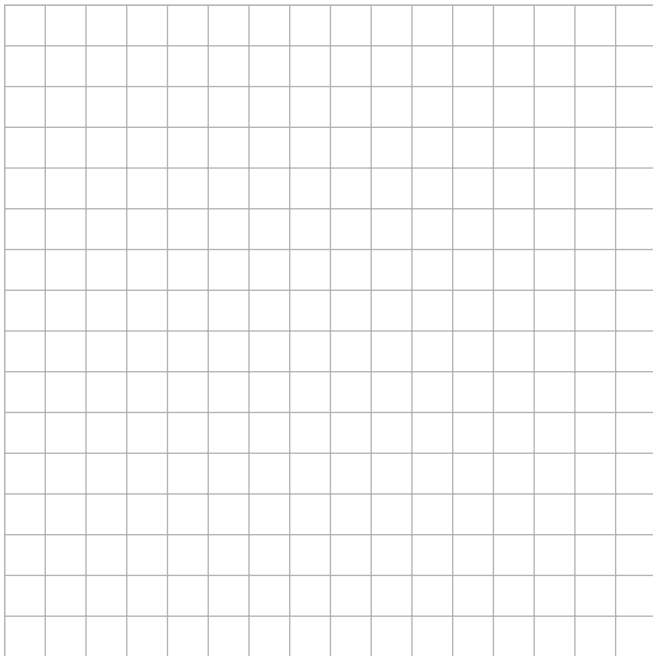
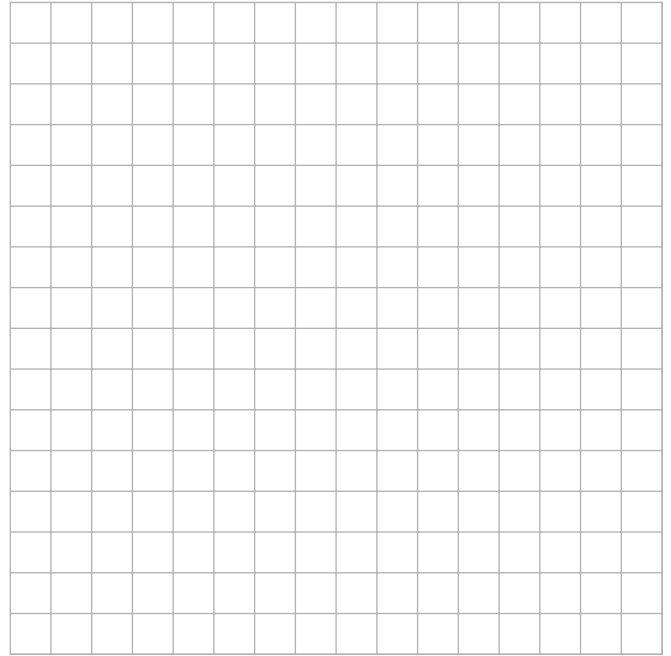
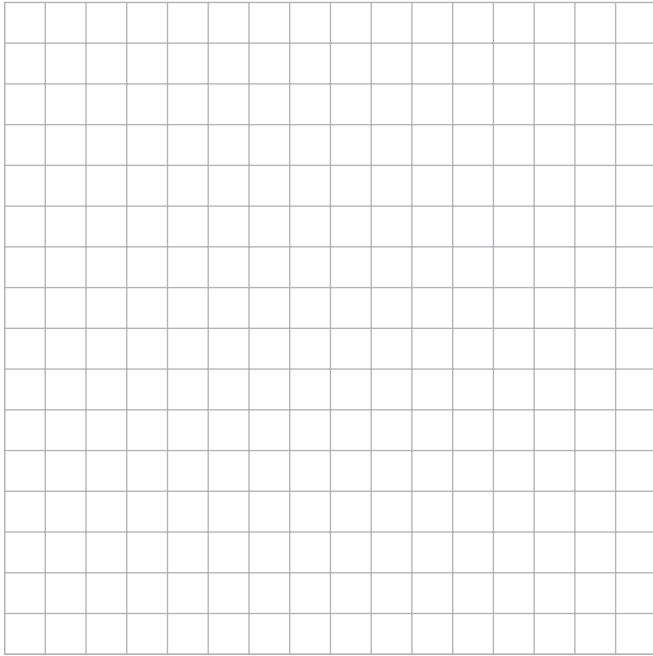
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$$F_z(z) = P[Z \leq z]$$

z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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

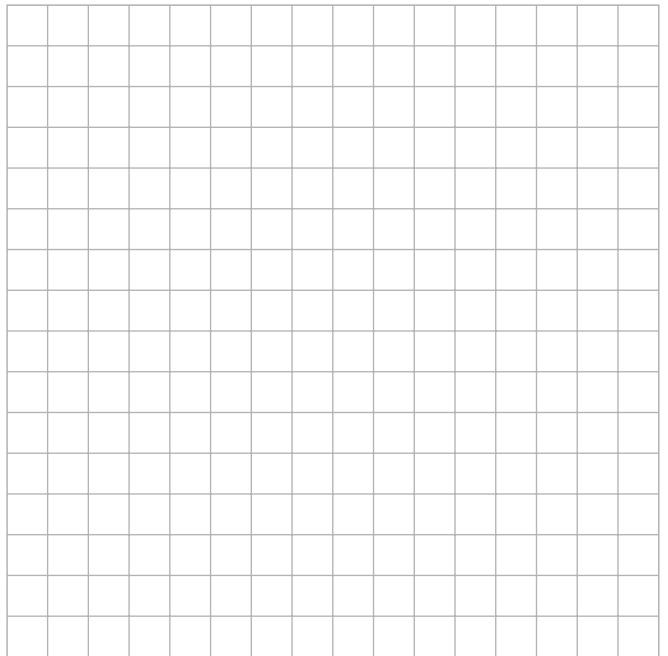
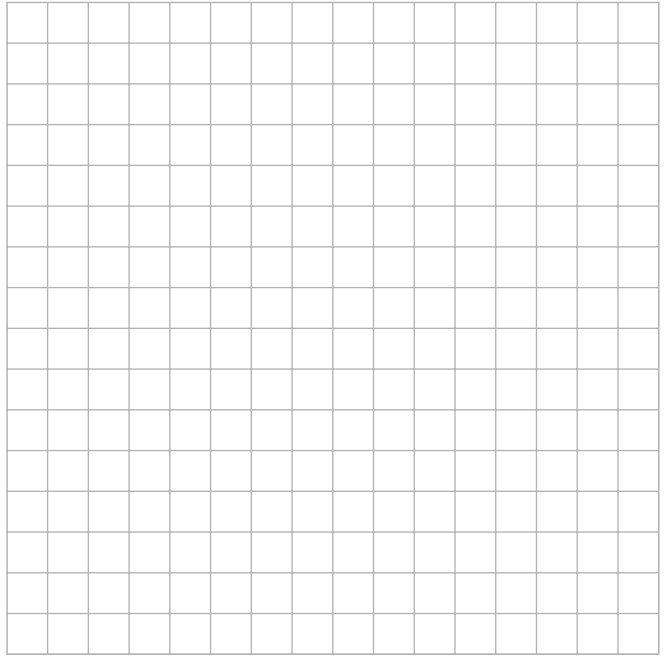
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ROUGH WORK FOR GRAPHING

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