BRITISH COLUMBIA

© 2002 Ministry of Education

Principles of Mathematics 12

April 2002

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 1:

1. ☐ . ☐

(5)

Question 2:

2. ☐ . ☐

(5)

Question 3:

3. ☐ . ☐

(5)

Question 4:

4. ☐ . ☐

(5)

Question 5:

5. ☐ . ☐

(4)

Question 6a:

6. ☐ . ☐

(2)

Question 6b:

7. ☐ . ☐

(3)

Question 7a:

8. ☐ . ☐

(2)

Question 7b:

9. ☐ . ☐

(3)

☐ ☐ ☐ ☐

PRINCIPLES OF MATHEMATICS 12

April 2002

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: 7 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 you may show normalcdf (40, 50, 47, 10) or the equivalent syntax for your calculator.

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.

**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. Determine the period of $y = \tan x$.

    A.   1 radian

    B. $\dfrac{\pi}{2}$ radians

    C. π radians

    D. 2π radians

2. Given a circle with radius 10 cm, calculate the length of arc a which contains a sector angle $\theta = 2$ radians.

    A. 5π cm
    B. 10π cm
    C.   10 cm
    D.   20 cm

OVER
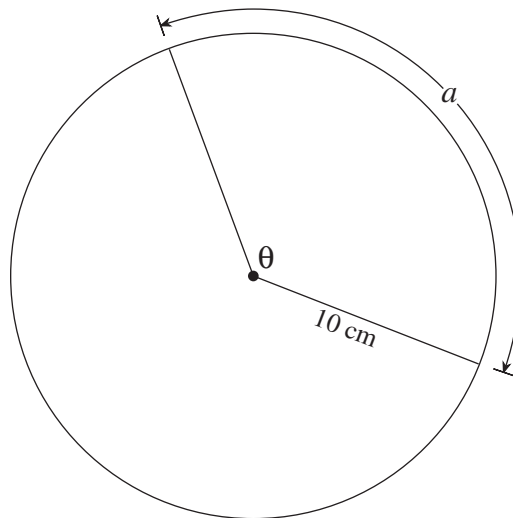
3. Find the exact value of $\tan \dfrac{5\pi}{3}$.

    A. $-\sqrt{3}$

    B. $-\dfrac{1}{\sqrt{3}}$

    C. $\dfrac{1}{\sqrt{3}}$

    D. $\sqrt{3}$

4. Solve: $\cos x = 2x$, $0 \le x < 2\pi$

    A.   0.45
    B.   0.58
    C.   0.90
    D.   no solution

5. The expression $\cos 3x \cos 2x - \sin 3x \sin 2x$ is equal to

    A. $\sin x$
    B. $\sin 5x$
    C. $\cos x$
    D. $\cos 5x$

6. Solve: $2\cos^2 x - 1 = 0$, $0 \le x < 2\pi$

    A. $\dfrac{\pi}{4}, \dfrac{7\pi}{4}$

    B. $\dfrac{\pi}{3}, \dfrac{5\pi}{3}$

    C. $\dfrac{\pi}{4}, \dfrac{3\pi}{4}, \dfrac{5\pi}{4}, \dfrac{7\pi}{4}$

    D. $\dfrac{\pi}{3}, \dfrac{2\pi}{3}, \dfrac{4\pi}{3}, \dfrac{5\pi}{3}$

7. Determine the maximum value of the function $f(x) = a\cos x + d$, where $a > 0$ and $d > 0$.

    A. a

    B. $d - a$

    C. $a + d$

    D. $2a + d$

8. Simplify: $\dfrac{\cos\theta}{\cot\theta} + \dfrac{1}{\csc\theta}$

    A. $\csc\theta$

    B. $2\sin\theta$

    C. $2\cot\theta$

    D. $\sin\theta + \cos\theta$

9. The terminal arm of angle θ in standard position passes through point $(m,\ n)$ where $m > 0, n > 0$. Determine the value of $\sin(\pi + \theta)$.

    A. $\dfrac{-n}{\sqrt{m^2 + n^2}}$

    B. $\dfrac{-m}{\sqrt{m^2 + n^2}}$

    C. $\dfrac{n}{\sqrt{m^2 + n^2}}$

    D. $\dfrac{m}{\sqrt{m^2 + n^2}}$

10. A wheel of radius 30 cm has its centre 36 cm above the ground. It rotates once every 12 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 minimum height at $t = 0$ seconds.

    A. $h = -30\cos\dfrac{\pi}{12}t + 6$

    B. $h = -30\cos\dfrac{\pi}{6}t + 6$

    C. $h = -30\cos\dfrac{\pi}{12}t + 36$

    D. $h = -30\cos\dfrac{\pi}{6}t + 36$

OVER

11. Determine the common ratio of the geometric series:

$$3 - 1 + \frac{1}{3} - \frac{1}{9} + \dots + \frac{1}{243}$$

    A. -3

    B. $-\frac{2}{3}$

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

    D. $\frac{1}{3}$

12. Calculate the 9th term of the geometric sequence: 8 000, 4 000, 2 000, …

    A.   8
    B.   15.625
    C.   31.25
    D.   2 048 000

13. If the sum of the first 5 terms of a geometric series is -328 and the common ratio is -4, determine the first term.

    A. -3.86
    B. -1.6
    C. 0.96
    D. 6.43

14. Evaluate: $\displaystyle\sum_{k=1}^{\infty} 50\left(\frac{1}{4}\right)^{k}$

    A. $\frac{75}{8}$

    B. $\frac{50}{4}$

    C. $\frac{50}{3}$

    D. $\frac{200}{3}$

15. For a geometric sequence, $t_7 = 5x + 2$ and $t_{10} = x - 23$. If the common ratio, r, is 2, find the value of t_{10}.

    A. -26

    B. -24

    C. -12

    D. -3

16. Change $y = \log_7 x$ to exponential form.

    A. $y = x^7$

    B. $y = 7^x$

    C. $x = y^7$

    D. $x = 7^y$

17. What is the domain of $y = \log_3(4x - 1) + 3$?

    A. $x > 0$

    B. $x > 1$

    C. $x > \dfrac{1}{4}$

    D.   all real numbers

18. Simplify the expression: $\log_a\left(\dfrac{1}{a^b}\right)$

    A. $-b$

    B. b

    C. a^b

    D. a^{-b}

19. The intensity of light is reduced by 2% for each metre that a diver descends below the surface of the water. At what depth is the intensity of light only 10% of that at the surface?

    A.   5 m

    B.   18 m

    C.   98 m

    D.   114 m

OVER

20. Solve for x: $5^{x-1} = 125^{3-x}$

    A. 2

    B. 5

    C. $\frac{2}{5}$

    D. $\frac{5}{2}$

21. In chemistry, 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 9 is 10 times more alkaline than a pH of 8. If a solution has a pH of 7.6, how many times more alkaline is it than neutral water which has a pH of 7?

pH Scale

increasing acidity ← | → increasing alkalinity

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14

neutral water
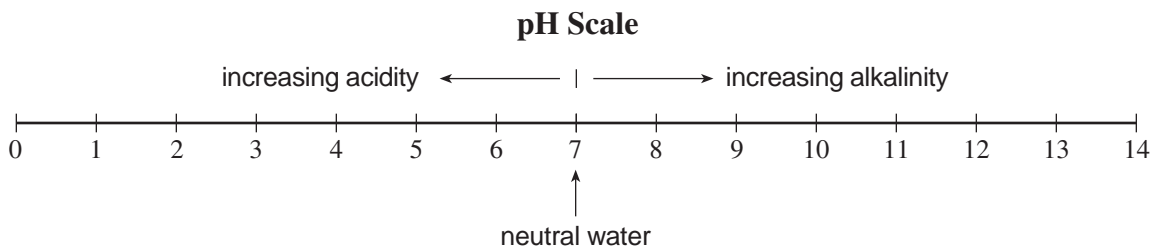
    A. 0.6
    B. 1.09
    C. 3.98
    D. 12.18

22. Determine an expression for: $\displaystyle\sum_{n=1}^{5} \log_a n$

    A. $\log_a 5$
    B. $\log_a 6$
    C. $\log_a 15$
    D. $\log_a 120$

23. Determine the length of the transverse axis of $\dfrac{x^2}{1} - \dfrac{y^2}{9} = 1$.

    A. 1
    B. 2
    C. 3
    D. 6

24. Determine an equation of the ellipse graphed below.
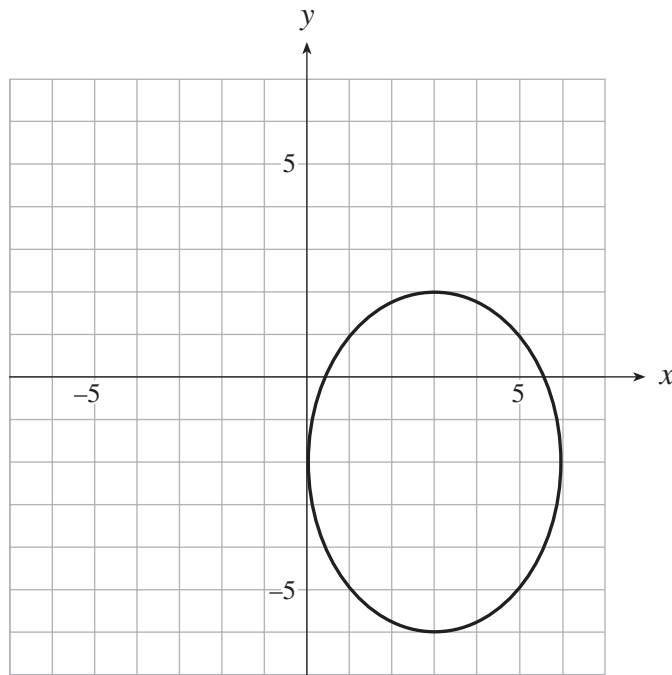
    A. $\dfrac{(x-3)^2}{3} + \dfrac{(y+2)^2}{4} = 1$

    B. $\dfrac{(x-3)^2}{9} + \dfrac{(y+2)^2}{16} = 1$

    C. $\dfrac{(x+3)^2}{3} + \dfrac{(y-2)^2}{4} = 1$

    D. $\dfrac{(x+3)^2}{9} + \dfrac{(y-2)^2}{16} = 1$

25. Determine the equation of the circle with centre $(4, -3)$ that passes through the point $(2, 1)$.

A. $(x+4)^2 + (y-3)^2 = 2\sqrt{10}$

B. $(x+4)^2 + (y-3)^2 = 40$

C. $(x-4)^2 + (y+3)^2 = 2\sqrt{5}$

D. $(x-4)^2 + (y+3)^2 = 20$

26. Which of the following best represents the graph of the relation $Ax^2 + By + C = 0$ where A, B and C are positive integers?
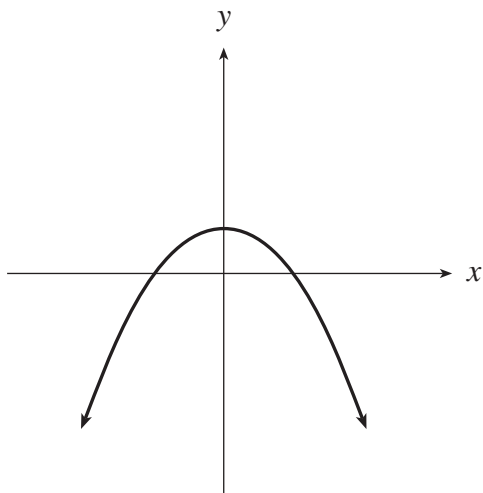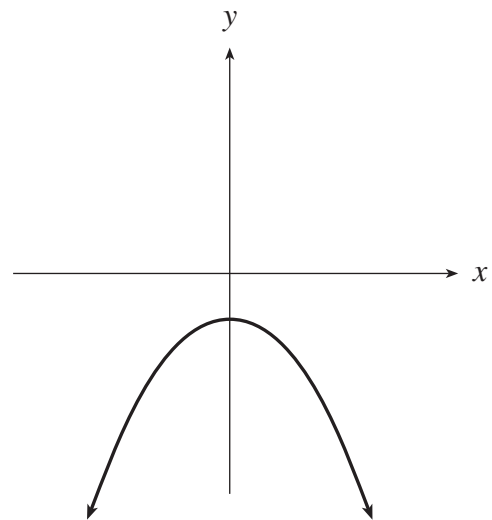
A.
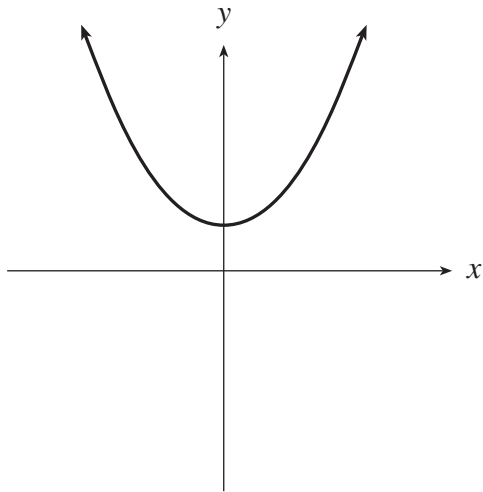
B.
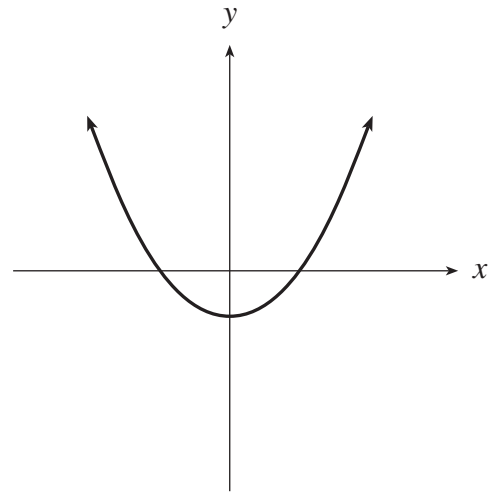
C.

D.

27. Given the function $y = f(x)$, which of the following represents its reflection in the y-axis?

A. $y = f(-x)$

B. $y = -f(x)$

C. $x = f(y)$

D. $y = \dfrac{1}{f(x)}$

28. How is the graph of $y = \dfrac{1}{7}f(x)$ related to the graph of $y = f(x)$?

A. $y = f(x)$ has been compressed vertically by a factor of $\dfrac{1}{7}$.

B. $y = f(x)$ has been compressed horizontally by a factor of $\dfrac{1}{7}$.

C. $y = f(x)$ has been expanded vertically by a factor of 7.

D. $y = f(x)$ has been expanded horizontally by a factor of 7.

29. Given $f(x) = x^3 - 27$, determine $f^{-1}(x)$, the inverse of $f(x)$.

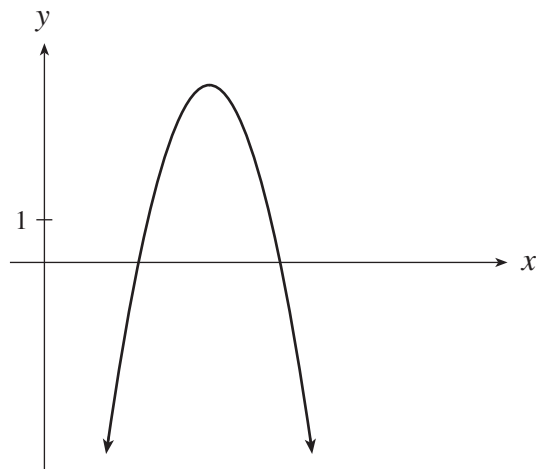A. $f^{-1}(x) = \sqrt[3]{x + 27}$

B. $f^{-1}(x) = \sqrt[3]{x - 27}$
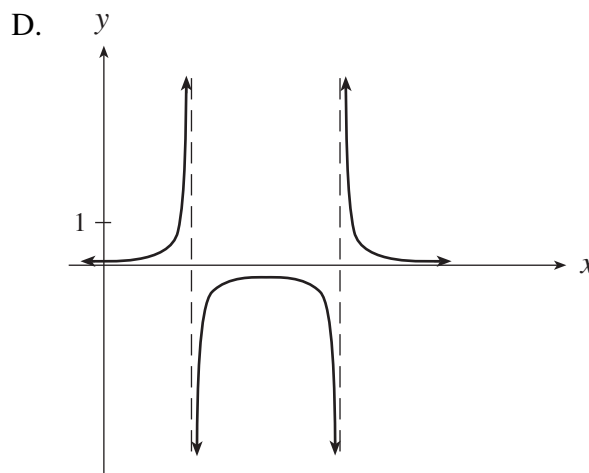
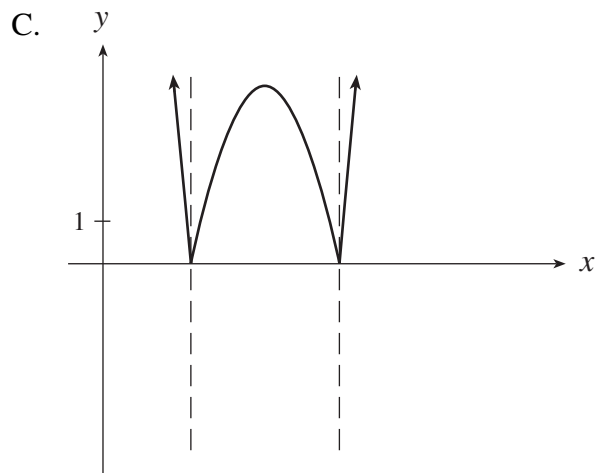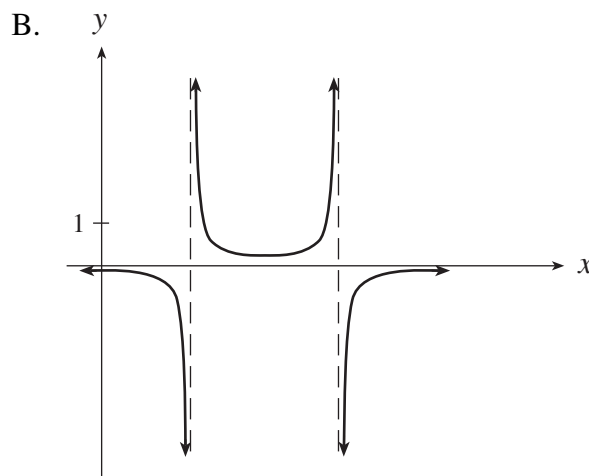C. $f^{-1}(x) = \sqrt[3]{x} + 3$
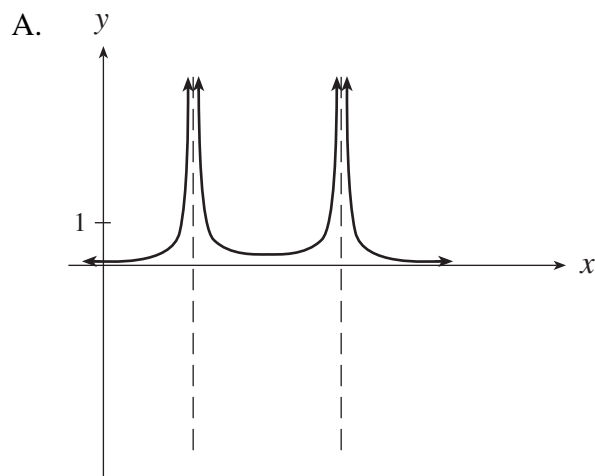
D. $f^{-1}(x) = x^3 + 27$

OVER

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

Which of the following is a graph of $y = \dfrac{1}{|f(x)|}$?

A.

B.

C.

D.

31. If $(4,\ -3)$ is a point on the graph of $y = f(x)$, what must be a point on the graph of $y = f(2x+10)$?

 A. $(-8,\ -3)$
 B. $(-3,\ -3)$
 C. $(3,\ -3)$
 D. $(18,\ -3)$

32. A soccer coach must choose 3 out of 10 players to kick tie-breaking penalty shots. Assuming the coach must designate the order of the 3 players, determine the number of different arrangements she has available.

 A. $\dfrac{10!}{7!}$

 B. $\dfrac{10!}{3!}$

 C. $\dfrac{10!}{3!\,7!}$

 D. $\dfrac{10!}{3!\,3!\,4!}$

33. Determine the 4th term in the expansion of $(x-2y)^5$.

 A. $-80x^2y^3$
 B. $-40x^3y^2$
 C. $40x^3y^2$
 D. $80x^2y^3$

34. Consider the four events shown below involving randomly drawing a card from a standard deck of 52 cards. Which of these events are mutually exclusive?

> F: the card is a face card
> K: the card is a King
> S: the card is a spade
> H: the card is a heart

A. F and H
B. F and K
C. S and H
D. S and K

35. A box contains 3 red candies, 11 green candies and 14 black candies. If two candies are randomly selected without replacement from the box, what is the probability that they are both black?

A. $\dfrac{13}{56}$

B. $\dfrac{13}{54}$

C. $\dfrac{1}{4}$

D. $\dfrac{27}{28}$

36. Two fair coins are tossed. What is the probability of 2 tails, given at least one is a tail?

A. $\dfrac{1}{4}$

B. $\dfrac{1}{3}$

C. $\dfrac{1}{2}$

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

37. The expression $\dfrac{\sum x_i}{n}$ represents which of the following statistical terms?

    A.   mean
    B.   standard error
    C.   margin of error
    D.   standard deviation

38. Calculate the standard deviation of the following population: 1, 2, 3, 4, 5, 6, 7

    A.   1.31
    B.   1.71
    C.   2.00
    D.   4.00

39. The temperature in a BC town for a year is normally distributed with a mean temperature of $20°C$ and a standard deviation of $4°C$. What is the probability that on any given day the temperature is between $16°C$ and $22°C$?

    A.   40%
    B.   47%
    C.   53%
    D.   60%

40. In a shipment of bananas, the bananas have lengths which are normally distributed with a mean length of 20 cm and a standard deviation of 2 cm. If the shortest 10% of the bananas are rejected, determine the length of the shortest banana that is kept.

    A.   15.35 cm
    B.   16.71 cm
    C.   17.44 cm
    D.   18.32 cm

41. A fair die is rolled 120 times. When using the normal approximation to estimate the probability that a six (6) will show between 25 to 35 times inclusive, which of the following gives the most appropriate approximation?

    A. $P(1.10 < Z < 3.80)$
    B. $P(1.22 < Z < 3.67)$
    C. $P(1.35 < Z < 3.55)$
    D. $P(1.35 < Z < 3.80)$

42. At which of the following points is the relation $\log(y - x) + \log(y + x) = \log 9$ not defined?

    A. $(0, 3)$
    B. $(-4, 5)$
    C. $(4, -5)$
    D. $(4, 5)$

43. Two boxes each contain 4 cupcakes. One box has 3 chocolate and 1 vanilla, and the other box has 2 chocolate and 2 vanilla. A box is randomly selected, opened, and a cupcake is randomly selected. This first cupcake is vanilla. If one more cupcake is randomly selected from the same box, what is the probability that it will be vanilla?

    A. $\dfrac{2}{9}$

    B. $\dfrac{1}{4}$

    C. $\dfrac{2}{7}$

    D. $\dfrac{3}{8}$

44. The graph of Math Mouse, $y = m(x)$ as shown in Graph 1 is transformed to the graph shown in Graph 2.
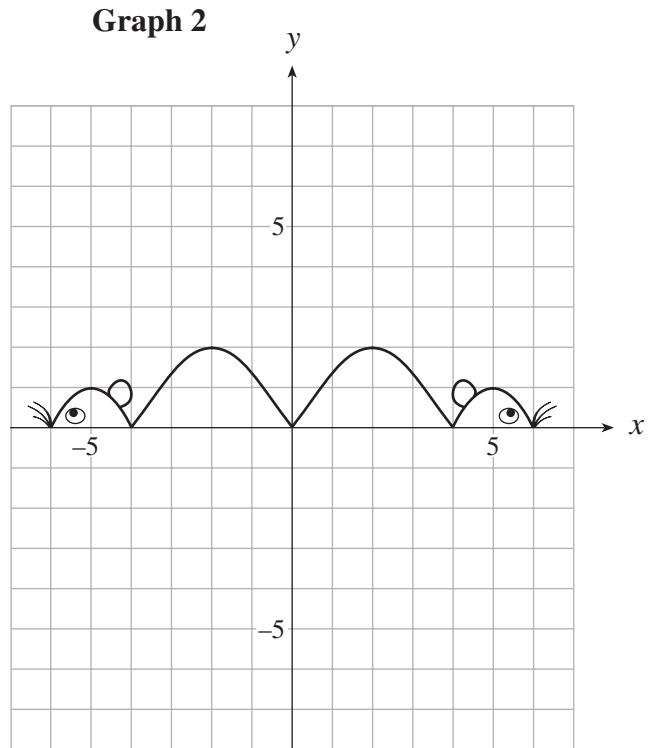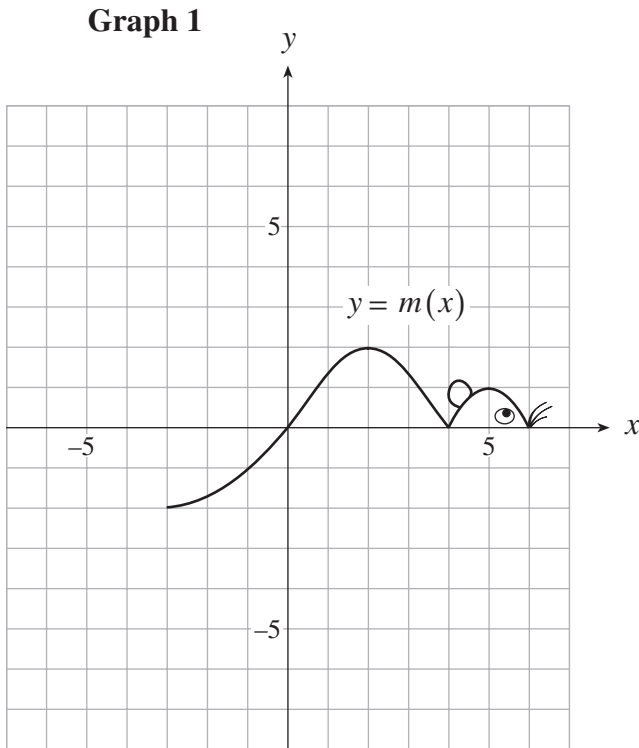
Graph 1

Graph 2

Which of the following is the equation of Graph 2?

A. $y = m(-x)$

B. $y = -m(x)$

C. $y = |m(x)|$

D. $y = m(|x|)$

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

OVER

THIS PAGE INTENTIONALLY BLANK

PART B: WRITTEN RESPONSE

Value: 34 marks   **Suggested Time: 45 minutes**

1. Change to standard form. **(5 marks)**

$$4x^2 - 9y^2 + 32x + 18y + 91 = 0$$

$$4x^2 - 9y^2 + 32x + 18y + 91 = 0$$

ANSWER:

2. Solve algebraically. **(5 marks)**

$$\log_2(2-2x)+\log_2(1-x)=5$$

ANSWER:

3. A biologist determines that a particular type of bacteria grows continuously according to the formula $P = P_0 e^{kt}$. Determine the value of the continuous growth rate if the population of the bacteria increases from 500 to 1500 in 8 days. **(5 marks)**

ANSWER:

4. Prove: **(5 marks)**

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

LEFT SIDE	RIGHT SIDE

OVER

5. Solve algebraically: $\dfrac{(n-1)!}{(n-3)!} = 30$ **(4 marks)**

ANSWER:

6. The graph of the function $y = f(x)$ is shown below.
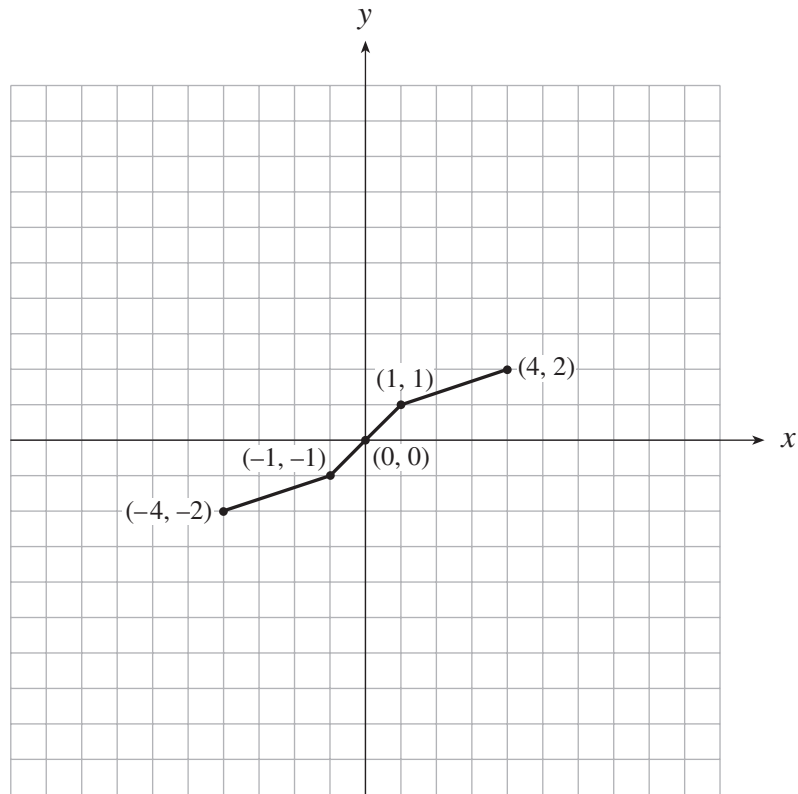
a) On the grid provided, sketch the graph of $y = 3f(x - 2)$. **(2 marks)**
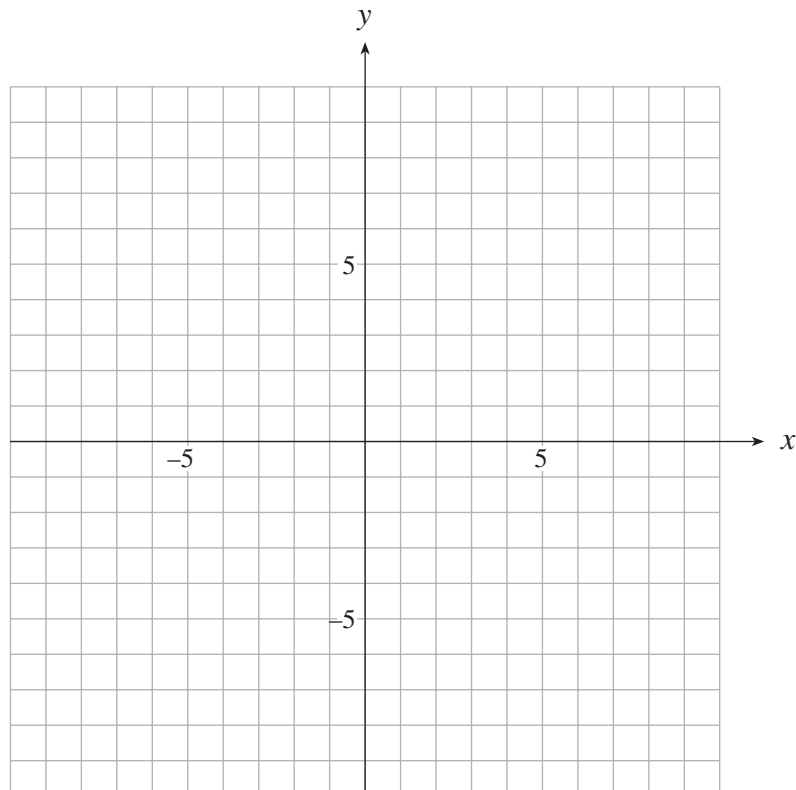
b) On the grid provided, sketch the graph of $y = -f\left(\dfrac{x}{2}\right)$.   **(3 marks)**

OVER
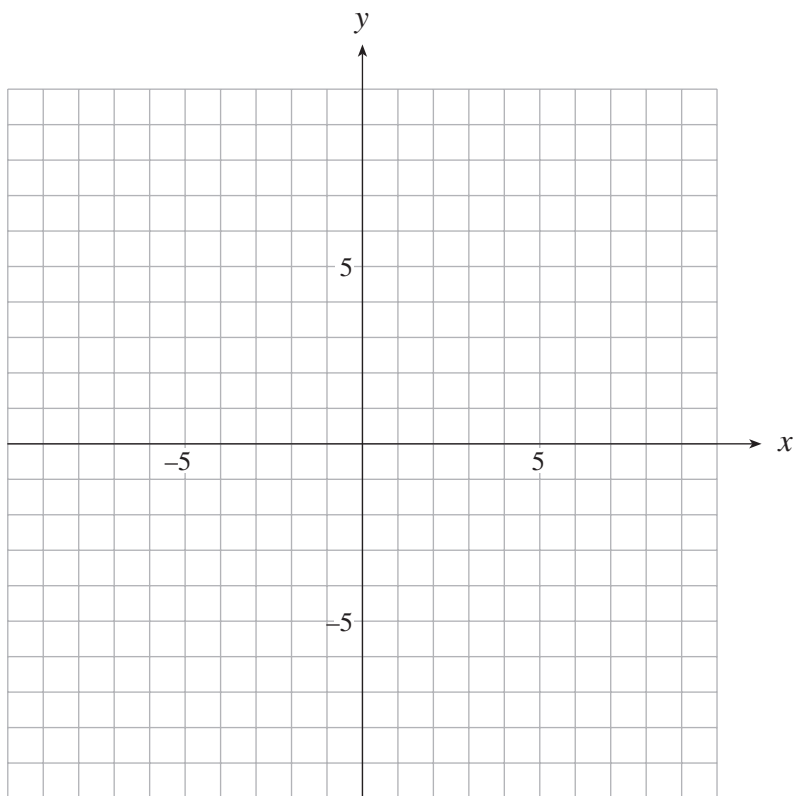
7. A hand of 5 cards is dealt from a standard deck of 52 cards.

    a) What is the probability that the hand contains 5 spades? (Answer accurate to at least 4 decimal places.) **(2 marks)**

    ```
    ANSWER:



    ```

b) What is the probability that the hand contains 2 hearts, 2 spades and 1 card that is not a heart or a spade? (Answer accurate to at least 4 decimal places.)   **(3 marks)**

ANSWER:

END OF EXAMINATION

THIS PAGE INTENTIONALLY BLANK

A SUMMARY OF BASIC IDENTITIES AND FORMULAE

Pythagorean Identities:

$$\sin^2\theta + \cos^2\theta = 1 \qquad\qquad 1 + \tan^2\theta = \sec^2\theta \qquad\qquad 1 + \cot^2\theta = \csc^2\theta$$

Reciprocal and Quotient Identities:

$$\sec\theta = \frac{1}{\cos\theta} \qquad\qquad \csc\theta = \frac{1}{\sin\theta} \qquad\qquad \cot\theta = \frac{1}{\tan\theta}$$

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

Addition Identities:

$$\cos(\alpha + \beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta \qquad\qquad \tan(\alpha + \beta) = \frac{\tan\alpha + \tan\beta}{1 - \tan\alpha\tan\beta}$$

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

$$\sin(\alpha + \beta) = \sin\alpha\cos\beta + \cos\alpha\sin\beta \qquad\qquad \tan(\alpha - \beta) = \frac{\tan\alpha - \tan\beta}{1 + \tan\alpha\tan\beta}$$

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

Double-Angle Identities:

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

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

$$= 1 - 2\sin^2\theta \qquad\qquad \tan 2\theta = \frac{2\tan\theta}{1 - \tan^2\theta}$$

Formulae:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a} \qquad\qquad t_n = ar^{n-1}$$

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c} \qquad\qquad S_n = \frac{a\left(1 - r^n\right)}{1 - r}$$

$$c^2 = a^2 + b^2 - 2ab\,\cos C \qquad\qquad S_n = \frac{a - \ell r}{1 - r}$$

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

You may detach this page for convenient reference.
Exercise care when tearing along perforations.

i

A SUMMARY OF BASIC IDENTITIES AND FORMULAE

Probability and Statistics:

$$_nP_r = \frac{n!}{(n-r)!} \qquad\qquad _nC_r = \binom{n}{r} = \frac{n!}{r!(n-r)!} \qquad\qquad t_{k+1} = {_nC_k}\, a^{n-k}\, b^k$$

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

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

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

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

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

$$\mu = np \qquad\qquad\qquad\qquad \sigma = \sqrt{npq} \qquad (q = 1 - p)$$

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

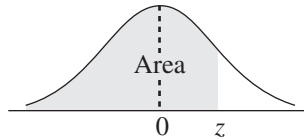$$\text{margin of error} \approx z_{\frac{\alpha}{2}}\sqrt{\frac{\hat{p}\hat{q}}{n}} \qquad\qquad \text{standard error} \approx \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

$$\hat{p} - z_{\frac{\alpha}{2}}\sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + z_{\frac{\alpha}{2}}\sqrt{\frac{\hat{p}\hat{q}}{n}}$$

note Graphing calculators will contain many of these formulae as pre-programmed functions.

THE STANDARD NORMAL DISTRIBUTION TABLE

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

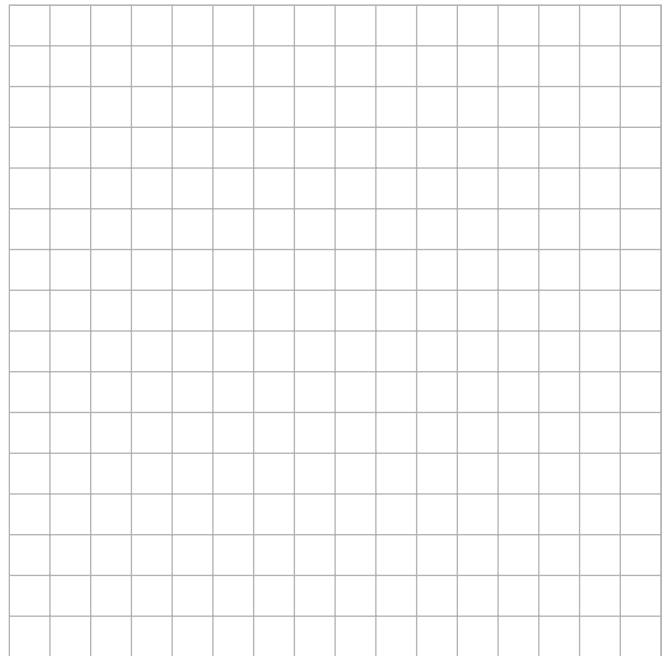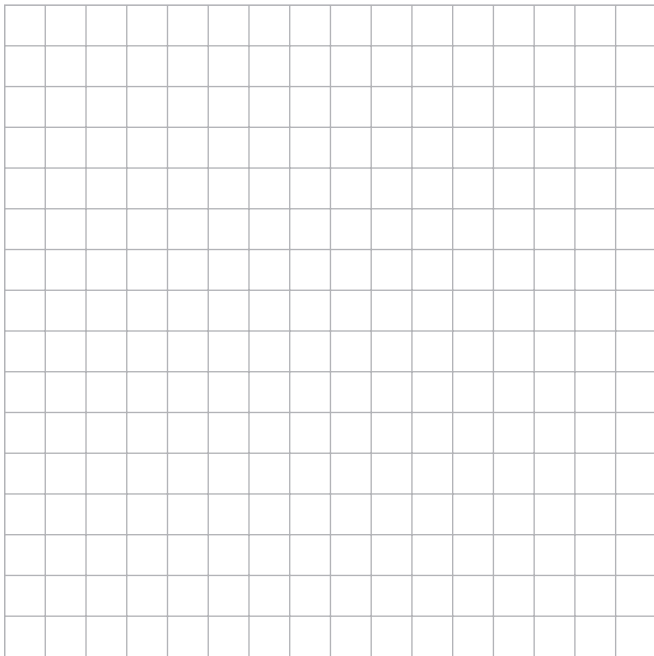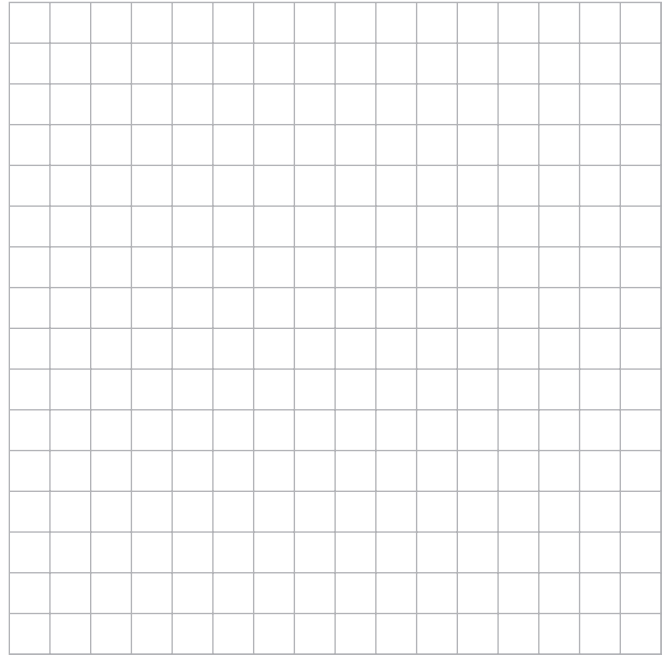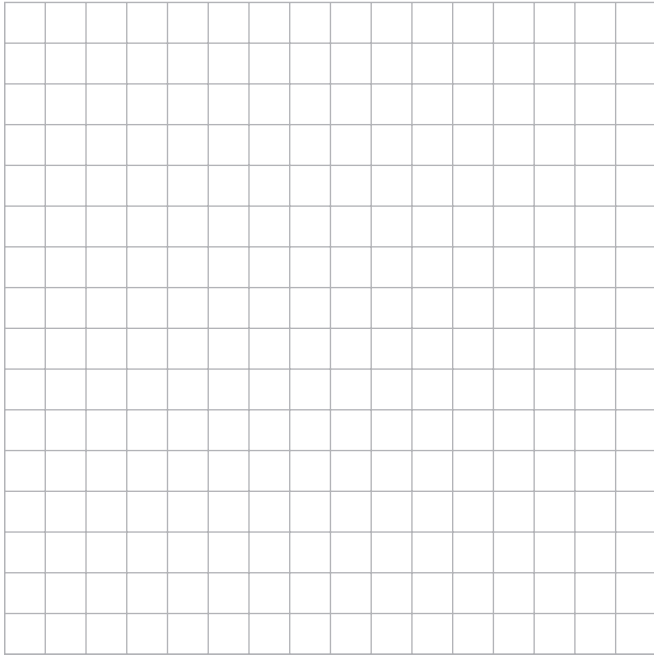| z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
−3.4	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002
−3.3	0.0005	0.0005	0.0005	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0003
−3.2	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0005	0.0005	0.0005
−3.1	0.0010	0.0009	0.0009	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

You may detach this page for convenient reference.
Exercise care when tearing along perforations.

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

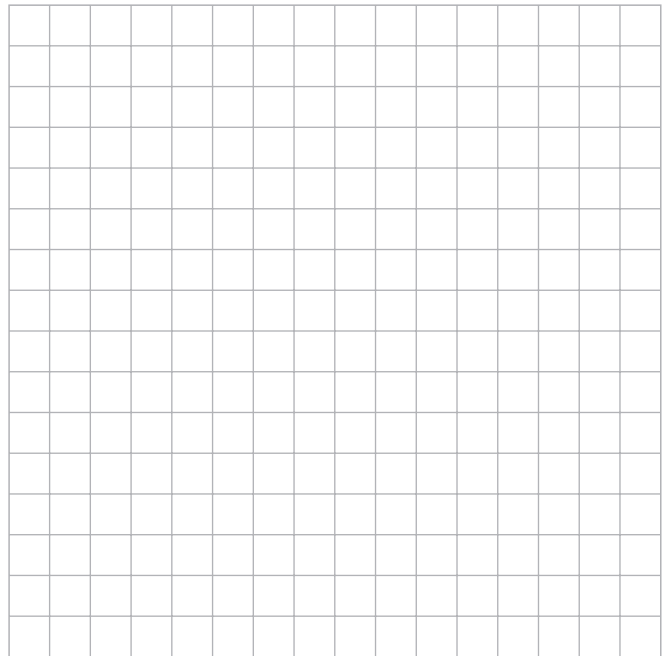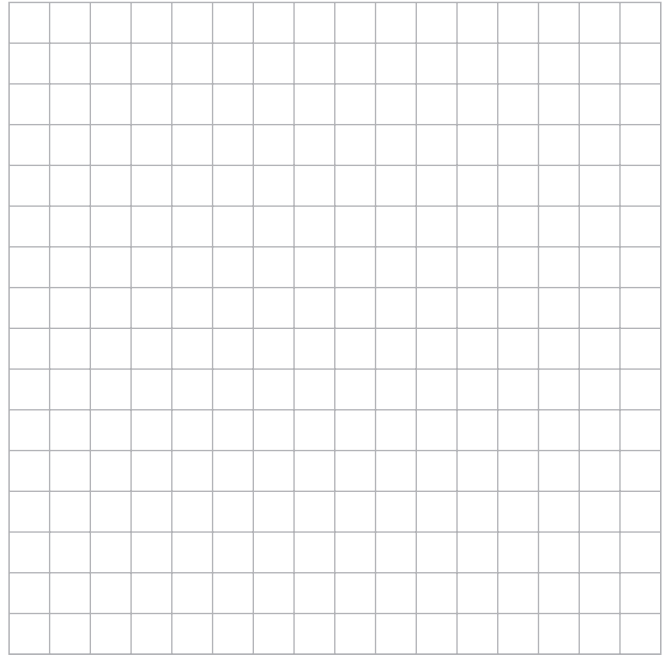| z	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	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

(No marks will be given for work done on this page.)

You may detach this page for convenient reference.
Exercise care when tearing along perforations.

ROUGH WORK FOR GRAPHING

(No marks will be given for work done on this page.)

You may detach this page for convenient reference.
Exercise care when tearing along perforations.

Rough Work For Multiple-Choice