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Principles of Mathematics 12

Sample Exam 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 1a:

1. .

(1)

Question 5:

8. .

(5)

Question 1b:

2. .

(1)

Question 6:

9. .

(5)

Question 1c:

3. .

(1)

Question 7a:

10. .

(2)

Question 1d:

4. .

(2)

Question 7b:

11. .

(3)

Question 2:

5. .

(5)

Question 3:

6. .

(4)

Question 4:

7. .

(5)



PRINCIPLES OF MATHEMATICS 12

Sample Exam 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 $\text{normalcdf}(40, 50, 47, 10)$ 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.

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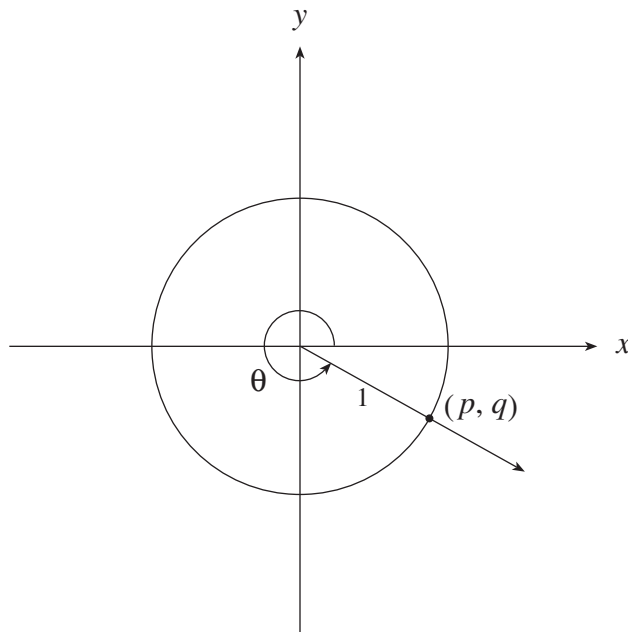
PART A: MULTIPLE CHOICE

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. If the diagram below shows a unit circle, determine $\cos \theta$.



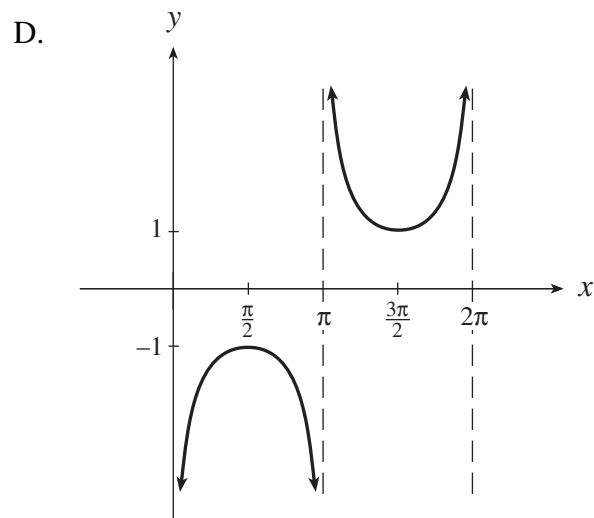
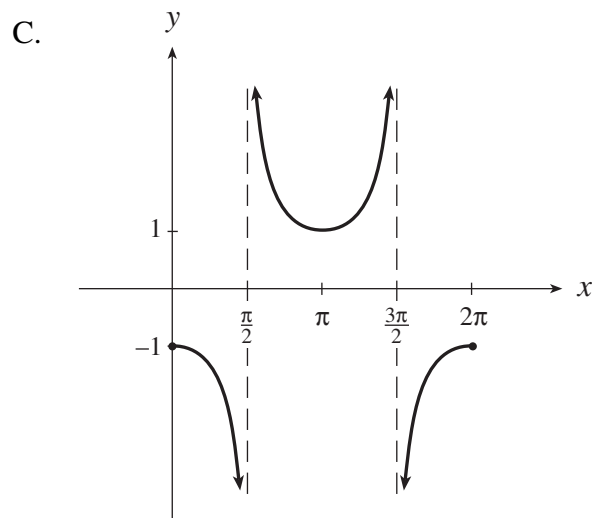
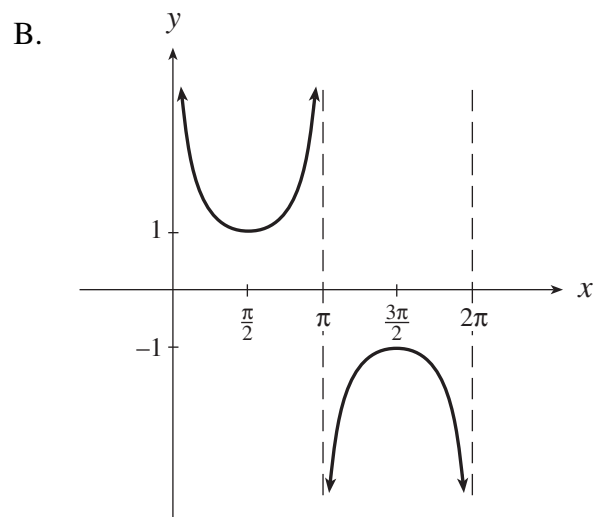
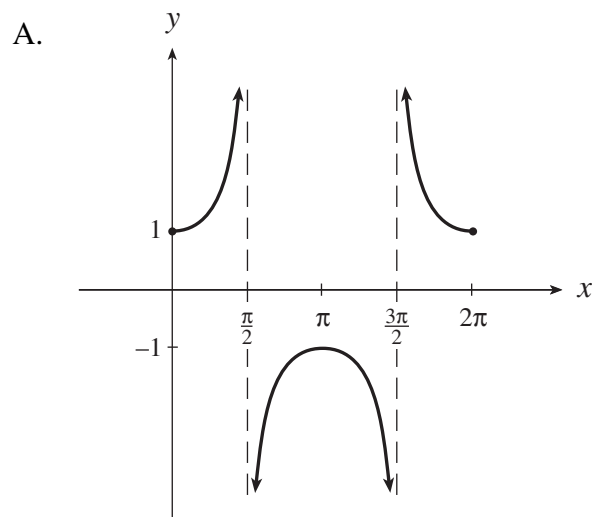
- A. p
B. q
C. $-p$
D. $-q$
2. Convert 150° to radians.

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

3. Determine the period of the function $y = \tan \frac{\pi}{5}x$.

- A. 5
- B. 10
- C. $\frac{\pi}{5}$
- D. $\frac{\pi}{10}$

4. Which graph best represents $y = \sec x$, $0 \leq x \leq 2\pi$?



5. Solve: $\sqrt{3} + 2 \sin x = 0$, $0 \leq x < 2\pi$ (Give exact solutions.)

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

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

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

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

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

A. 0.49, 4.22

B. 2.06, 5.80

C. 0.49, 1.57, 4.22, 4.71

D. 1.57, 2.06, 4.71, 5.80

7. Which expression is equivalent to $\frac{\cos 8x + 1}{2}$?

A. $\cos^2 4x$

B. $\sin^2 4x$

C. $\cos^2 16x$

D. $\sin^2 16x$

8. In the function $y = a \sin(x - c) + d$ where a , c and d are positive constants, determine the range of the new function formed if a is doubled.

A. $d - \frac{a}{2} \leq y \leq d + \frac{a}{2}$

B. $d - 2a \leq y \leq d + 2a$

C. $-d - \frac{a}{2} \leq y \leq -d + \frac{a}{2}$

D. $-d - 2a \leq y \leq -d + 2a$

OVER

9. Determine the general solution: $3 \sin 5x = 1$

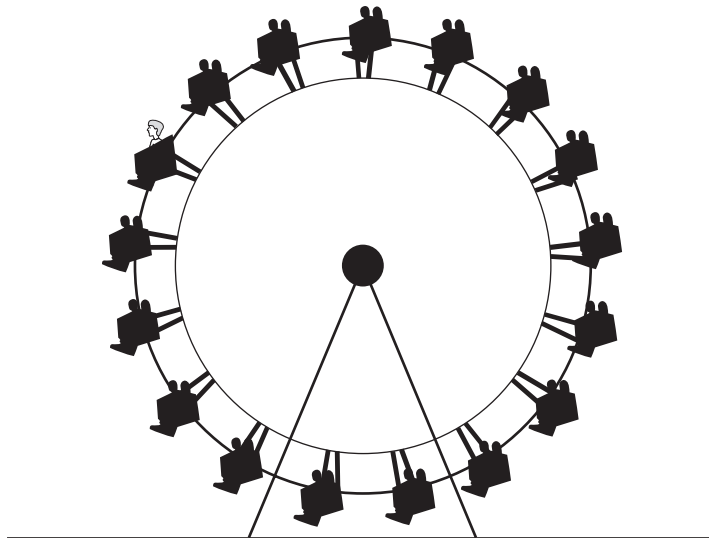
A. $x = 0.07 + \frac{2n\pi}{5}$, $x = 0.56 + \frac{2n\pi}{5}$

B. $x = 0.07 + \frac{2n\pi}{5}$, $x = 5.94 + \frac{2n\pi}{5}$

C. $x = 0.07 + 2n\pi$, $x = 0.56 + 2n\pi$

D. $x = 0.07 + 2n\pi$, $x = 5.94 + 2n\pi$

10. The Ferris wheel shown in the diagram has a radius of 16 m and its centre is 18 m above the ground. It rotates once every 60 s. Ethan gets on the Ferris wheel at its lowest point and then the wheel starts to rotate. How long does it take Ethan to reach 29 m above the ground for the first time?



A. 11.12 s

B. 22.24 s

C. 23.92 s

D. 37.76 s

11. Determine the common ratio of the geometric sequence: $3, \frac{2}{5}, \frac{4}{75}, \dots$

A. $\frac{2}{15}$

B. $\frac{3}{10}$

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

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

12. A geometric sequence has a common ratio of 2 and the 12th term in the sequence is 16 384. Determine the first term.

A. 2

B. 4

C. 8

D. 16

13. Evaluate: $\sum_{k=2}^6 2(3)^{k-2}$

A. 93

B. 186

C. 242

D. 728

14. In a geometric sequence $t_3 = 45$ and $t_6 = 1\,215$. Determine the first term.

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

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

C. 3

D. 5

OVER

15. The exponential function $y = 2^x$ can be used to determine the number of ancestors you had in a previous generation. For example, if $x = 2$, then $y = 4$ means that 2 generations ago you had 4 ancestors (your 4 grandparents). Determine an expression which represents the total number of ancestors you have had in the last n generations.

- A. $2(2^{n-1} - 1)$
- B. $2^n - 1$
- C. $2^{n+1} - 1$
- D. $2(2^n - 1)$

16. Change to exponential form: $\log_k \ell = m$

- A. $\ell = m^k$
- B. $\ell = k^m$
- C. $k = m^\ell$
- D. $k = \ell^m$

17. Determine the domain of the function $y = \log(2x + 3)$.

- A. $x > -\frac{3}{2}$
- B. $x > -\frac{2}{3}$
- C. $x > \frac{2}{3}$
- D. $x > \frac{3}{2}$

18. A recent earthquake in Washington measured 6.3 on the Richter scale. In 1964, the Alaskan earthquake measured 8.5. How many times as intense was the 1964 Alaskan earthquake compared to the recent Washington earthquake?

- A. 1.35
- B. 2.2
- C. $10^{1.35}$
- D. $10^{2.2}$

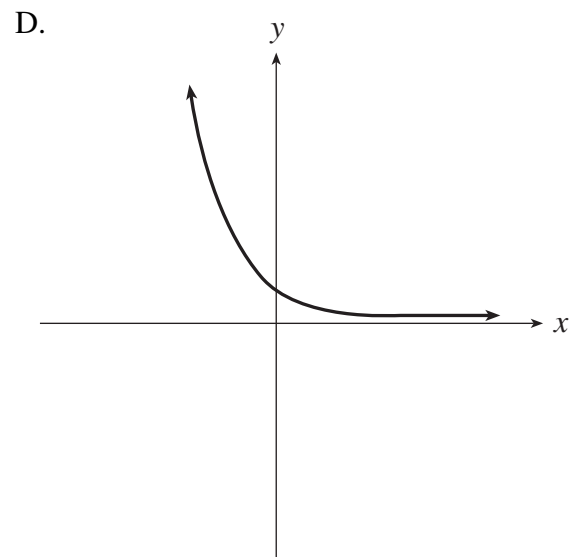
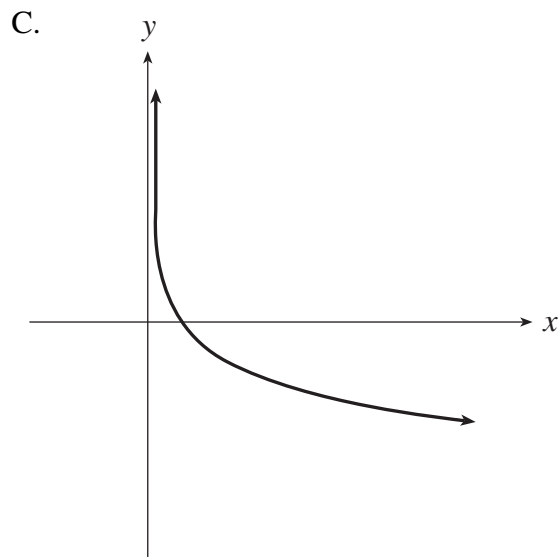
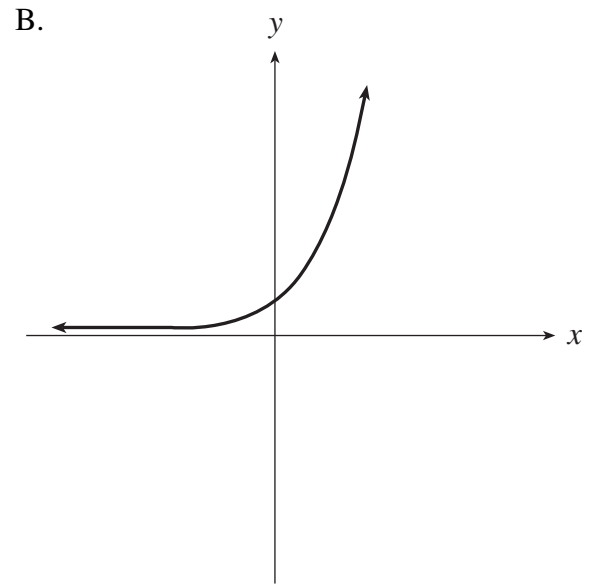
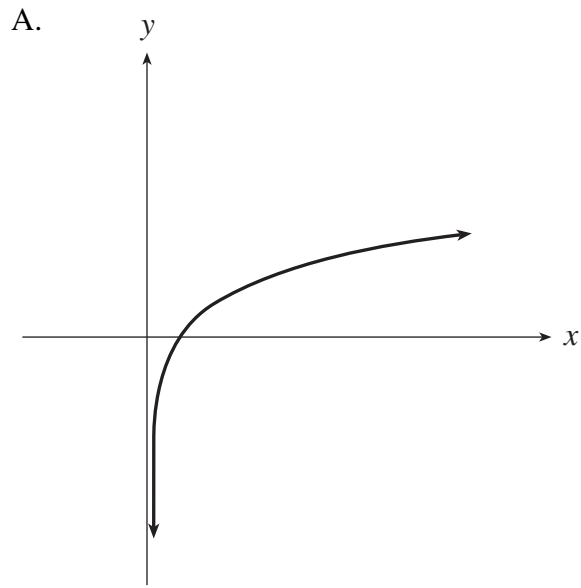
19. Solve for x : $\log_3(x - 6) + \log_3 x = 3$

- A. 4.5
- B. 9
- C. 16.5
- D. -3, 9

20. Solve for x : $81^{x-1} = \left(\frac{1}{27}\right)^{x-4}$

- A. -8
- B. -3
- C. $-\frac{3}{7}$
- D. $\frac{16}{7}$

21. If $0 < a < 1$, which of the following is the best graph of $y = \log_a x$?



22. Solve for x in terms of $\log a$, $\log b$, and $\log c$: $ab^x = c$

A. $x = \frac{\log c}{\log a + \log b}$

B. $x = \frac{\log c + \log a}{\log b}$

C. $x = \frac{\log c - \log a}{\log b}$

D. $x = \frac{\log c}{\log b} - \log a$

23. Determine the vertex of $x = -3(y + 5)^2 - 2$.

A. $(-5, -2)$

B. $(-2, -5)$

C. $(-2, 5)$

D. $(5, -2)$

24. Determine the equations of the asymptotes of $\frac{(x-1)^2}{9} - \frac{(y+2)^2}{4} = 1$.

A. $y + 2 = \pm \frac{2}{3}(x - 1)$

B. $y + 2 = \pm \frac{3}{2}(x - 1)$

C. $y + 2 = \pm \frac{4}{9}(x - 1)$

D. $y + 2 = \pm \frac{9}{4}(x - 1)$

25. Which of the following describes the graph of the relation $Ax^2 + y^2 = 16$ where $0 < A < 1$?

A. a circle with radius 4

B. an ellipse with a vertical major axis

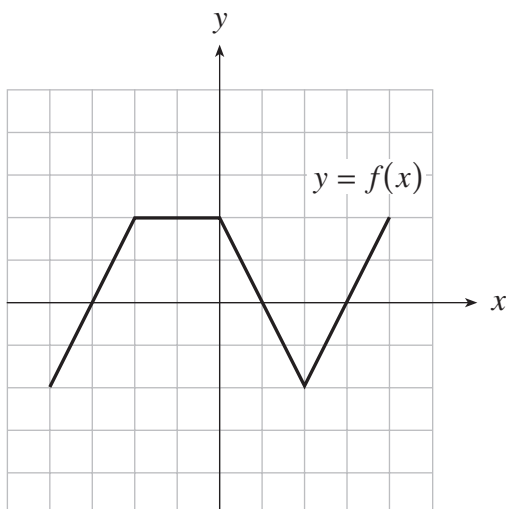
C. an ellipse with a horizontal major axis

D. a parabola with a vertical axis of symmetry

OVER

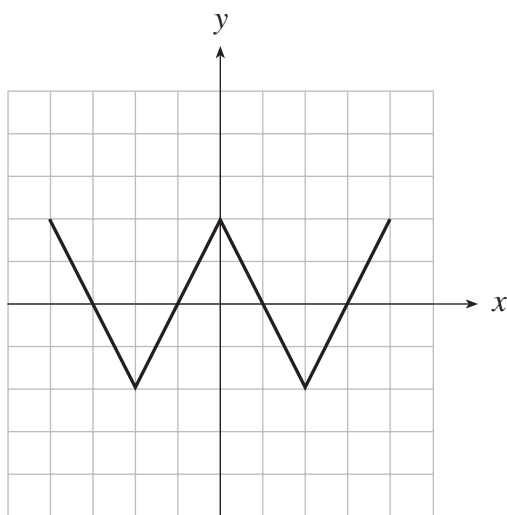
26. An ellipse is tangent to the lines $x = -5$ and $x = 1$. If the centre of the ellipse is on the line $y = 3$ and the length of the major axis is 12, determine the equation of the ellipse.
- A. $\frac{(x-2)^2}{9} + \frac{(y-3)^2}{36} = 1$
- B. $\frac{(x+2)^2}{9} + \frac{(y-3)^2}{36} = 1$
- C. $\frac{(x-2)^2}{9} + \frac{(y-3)^2}{144} = 1$
- D. $\frac{(x+2)^2}{9} + \frac{(y-3)^2}{144} = 1$
27. What is the inverse of the relation $y = (x+1)^3$?
- A. $y = \frac{1}{(x+1)^3}$
- B. $y = -(x+1)^3$
- C. $x = \sqrt[3]{y+1}$
- D. $x = (y+1)^3$
28. If the zeros of the function $y = f(x)$ are -2 and 3 , determine the equations of the vertical asymptotes of the function $y = \frac{1}{f(x)}$.
- A. $x = -2, x = 3$
- B. $x = 2, x = -3$
- C. $y = -2, y = 3$
- D. $y = 2, y = -3$
29. If $(6, -5)$ is a point on the graph of $y = f(x)$, what must be a point on the graph of $y = -f(2(x+2)) - 3$?
- A. $(-1, 2)$
- B. $(1, -2)$
- C. $(1, 2)$
- D. $(10, 2)$

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

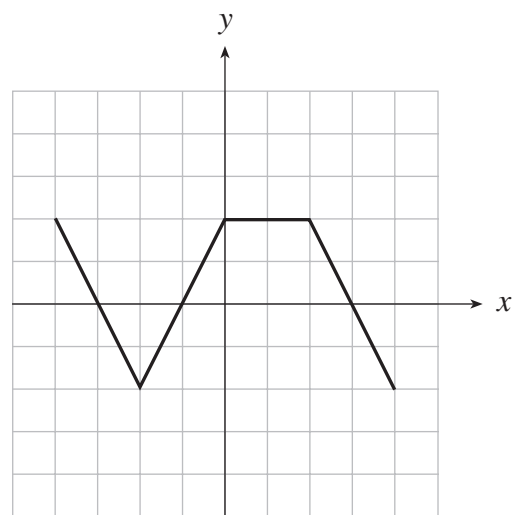


Which of the following is the graph of $y = |f(x)|$?

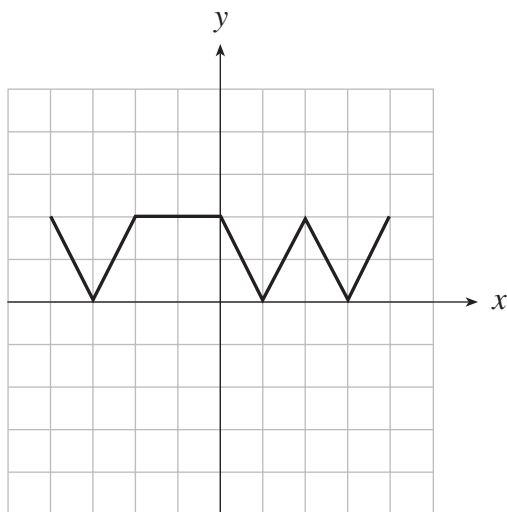
A.



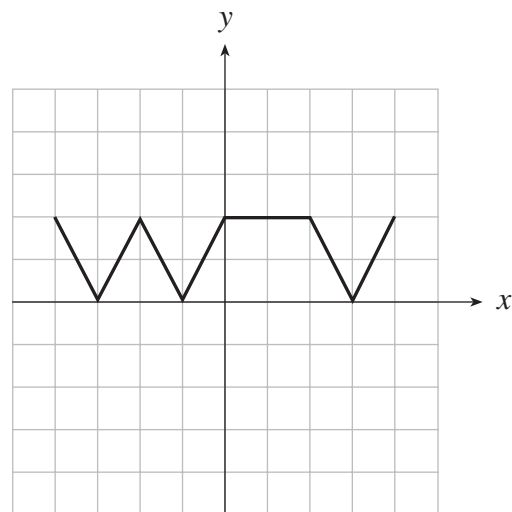
B.



C.



D.



OVER

31. Given the function $y_1 = f(x)$, describe how the graph of the new function, $y_2 = 4f(x - 2)$, is related to the graph of y_1 .
- A. The graph of y_1 has been vertically compressed by a factor of $\frac{1}{4}$ then translated 2 units right to form the graph of y_2 .
 - B. The graph of y_1 has been vertically expanded by a factor of 4 then translated 2 units right to form the graph of y_2 .
 - C. The graph of y_1 has been vertically compressed by a factor of $\frac{1}{4}$ then translated 2 units left to form the graph of y_2 .
 - D. The graph of y_1 has been vertically expanded by a factor of 4 then translated 2 units left to form the graph of y_2 .

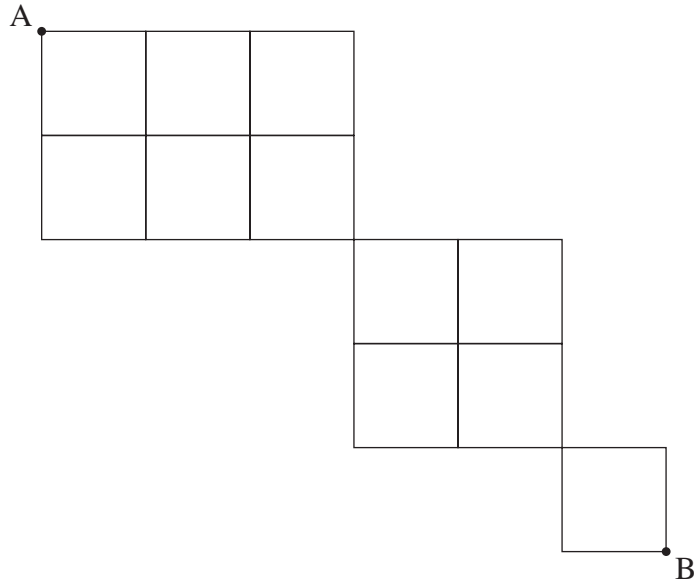
32. How many different committees of 2 people can be selected from 5 people?

- A. $\frac{5!}{2!}$
- B. $\frac{5!}{3!}$
- C. $\frac{5!}{2!3!}$
- D. $5!$

33. Determine the 5th term in the expansion of $\left(x - \frac{1}{2}y\right)^7$.

- A. $\frac{35}{8}x^4y^3$
- B. $\frac{35}{16}x^3y^4$
- C. $-\frac{35}{8}x^4y^3$
- D. $-\frac{35}{16}x^3y^4$

34. Moving only to the right or down, how many different paths exist to get from point A to point B?



- A. 22
- B. 60
- C. 120
- D. 144

35. Two cards are drawn from a well-shuffled deck of 52 cards. What is the probability that the first card is a heart and the second card is a heart if the experiment is carried out without replacement?

- A. $\frac{1}{16}$
- B. $\frac{13}{204}$
- C. $\frac{1}{17}$
- D. $\frac{3}{52}$

36. Three different names are randomly selected from the following list of five names.

Max
Kim
Codie
Lee
Alex

Determine the probability that “Kim” is one of the three names selected.

A. $\frac{3}{10}$

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

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

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

37. If a fair coin is flipped four times, what is the probability of obtaining exactly two heads?

A. $\frac{1}{16}$

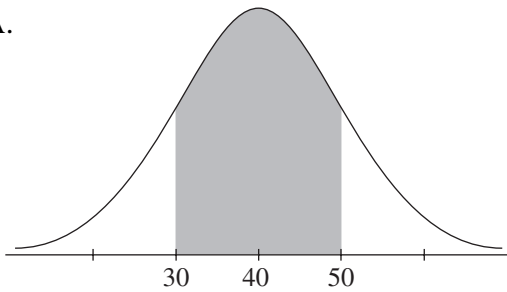
B. $\frac{1}{8}$

C. $\frac{3}{8}$

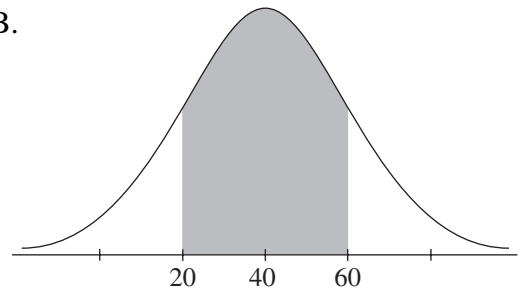
D. $\frac{1}{2}$

38. Which curve below shows a normal distribution with a mean of 40 and a standard deviation of 20 if the shaded region represents approximately 68% of the area under the curve?

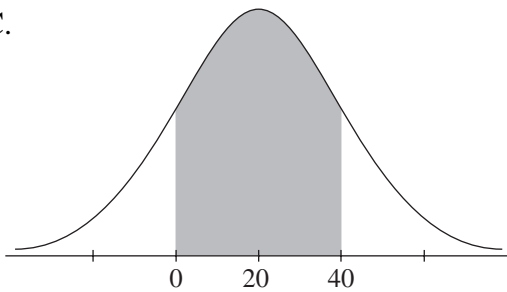
A.



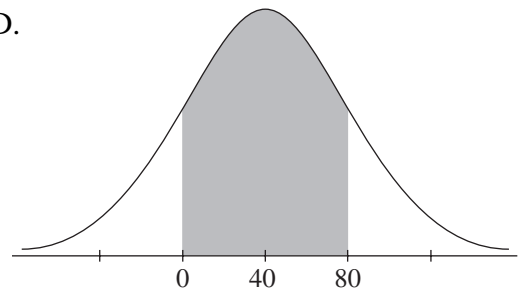
B.



C.



D.



39. Calculate the standard deviation of the population of weights shown in the following frequency table.

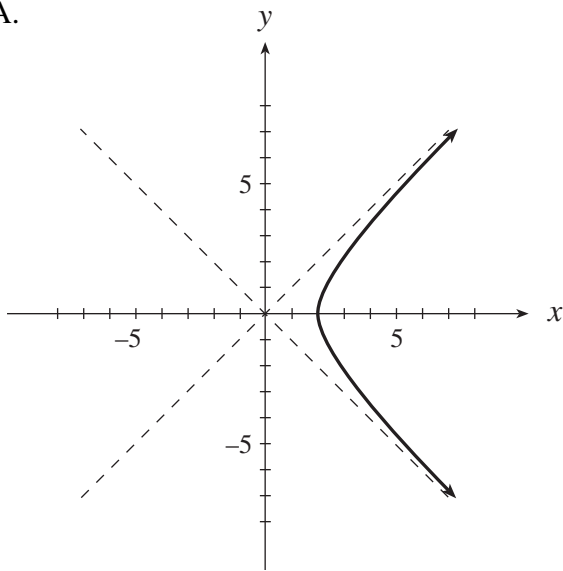
Weight (kg)	Frequency
15	4
17	2
19	3
23	5

- A. 0.88 kg
 B. 2.96 kg
 C. 3.30 kg
 D. 6.16 kg

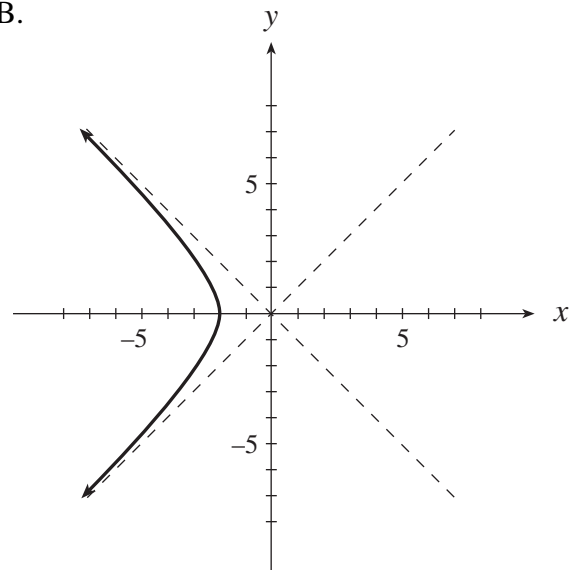
40. In the general population, the IQ scores of individuals is normally distributed with a mean of 110 and a standard deviation of 15. What is the probability that a randomly selected individual from the population has an IQ of 125 or higher?
- A. 1.50%
 B. 6.68%
 C. 15.87%
 D. 84.13%
41. When using the normal approximation to estimate the probability of obtaining between 20 to 40 heads inclusive when a fair coin is tossed 100 times, which of the following gives the most appropriate approximation?
- A. $P(-5.8 < Z < -2.2)$
 B. $P(-5.9 < Z < -2.1)$
 C. $P(-6.0 < Z < -2.0)$
 D. $P(-6.1 < Z < -1.9)$
42. A bank account earns interest at a rate of 7% per year compounded continuously. Which equation will determine the effective annual growth rate, r ? (P_0 is the initial amount invested; t is time, in years, over which the amount is invested.)
- A. $P_0(1+r)^t = P_0e^{0.07t}$
 B. $P_0(1.07)^t = P_0e^{rt}$
 C. $P_0(1+r)^t = P_0e^{1.07t}$
 D. $P_0(1.07)^t = P_0^{(1+r)t}$
43. In a sequence, $t_n = \sum_{k=1}^n \left(\frac{1}{x}\right)^{k-1}$. If $t_\infty = 3$, determine the value of x .
- A. $\frac{2}{3}$
 B. $\frac{3}{4}$
 C. $\frac{4}{3}$
 D. $\frac{3}{2}$

44. Which of the following is the graph of the relation $\log(x - y) + \log(x + y) = \log 4$?

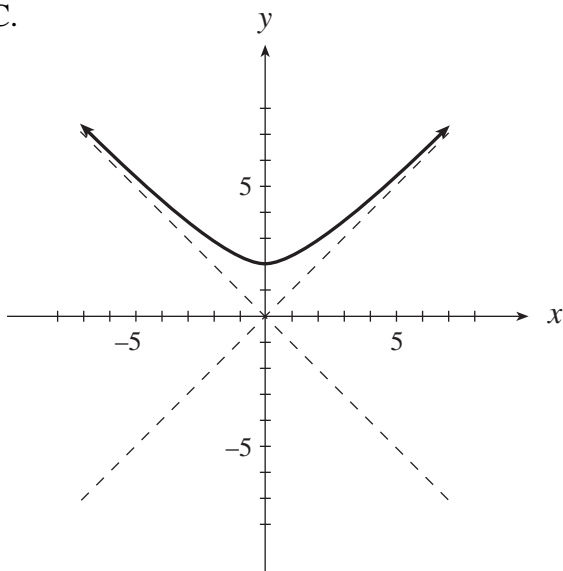
A.



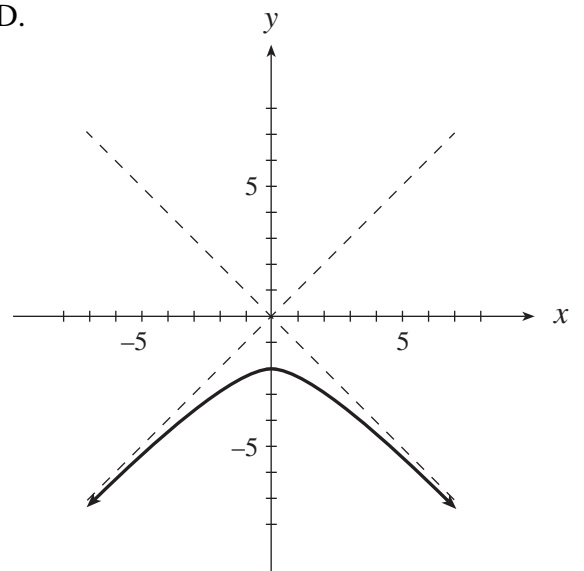
B.



C.



D.



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

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PART B: WRITTEN RESPONSE

Value: 34 marks

Suggested Time: 45 minutes

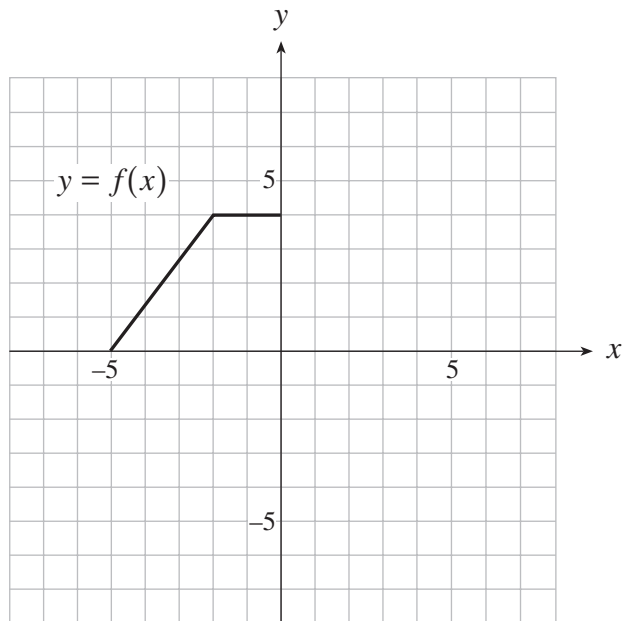
INSTRUCTIONS: Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question. Where required, place the final answer for each question in the space provided.

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 you may show $\text{normalcdf}(40, 50, 47, 10)$ or the equivalent syntax for your calculator.

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.

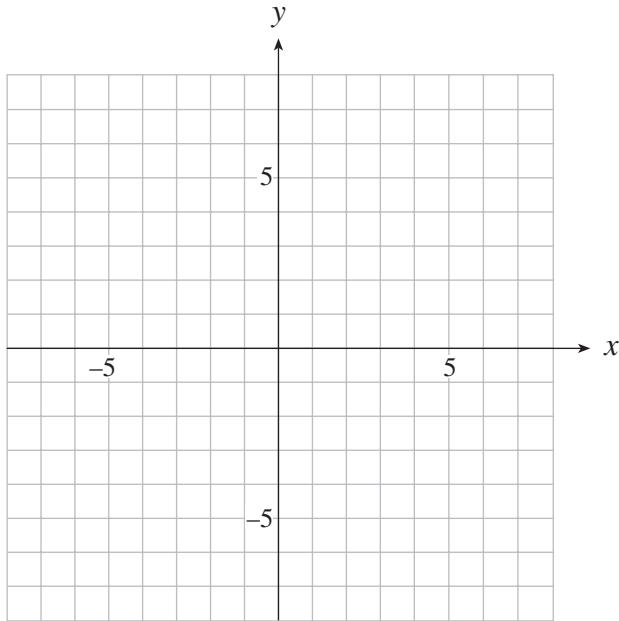
Full marks will NOT be given for the final answer only.

1. Given the graph of the function $y = f(x)$ below, sketch the graph of each relation on the grids provided.



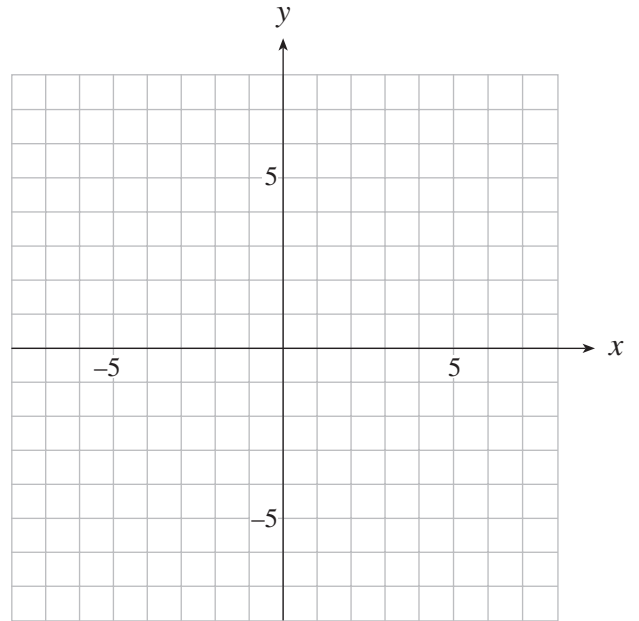
a) $y = f(-x)$

(1 mark)



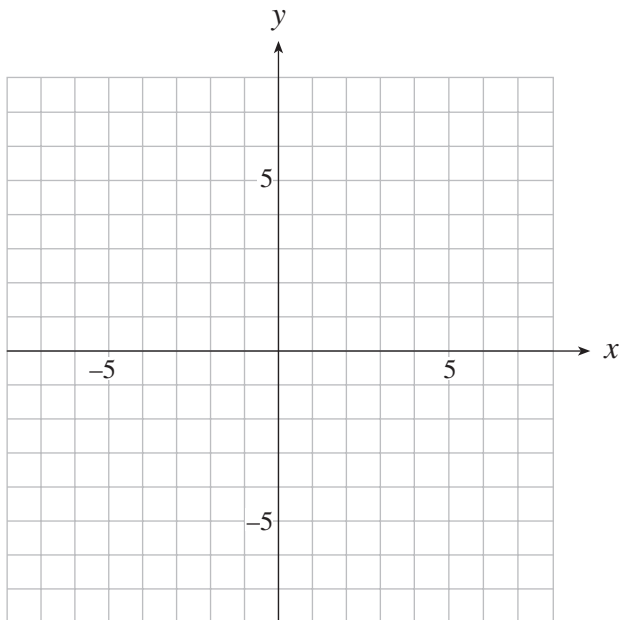
b) $y = f(x - 3)$

(1 mark)



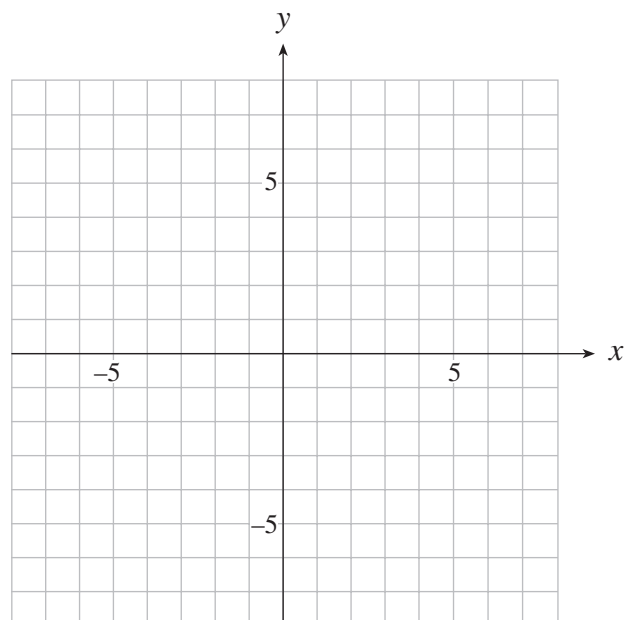
c) $y = 2f(x)$

(1 mark)



d) $x = f(y)$

(2 marks)



2. Change the following equation to standard form.

(5 marks)

$$x + 2y^2 + 12y + 16 = 0$$

ANSWER:

3. Solve algebraically: $\frac{n!}{(n-2)!4!} = 10$

(4 marks)

ANSWER:

4. Prove the identity:

(5 marks)

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

LEFT SIDE

RIGHT SIDE

5. If 3 150 mg of a radioactive substance decays to 450 mg in 73 weeks, determine the half-life of the substance to the nearest week. (Solve algebraically using logarithms.) **(5 marks)**

ANSWER:

6. Two factories produce safety pins. 65% of the safety pins come from factory A and the rest of the safety pins come from factory B. In factory A, 2% of the pins are defective; in factory B, 7% of the pins are defective. What is the probability that a defective pin comes from factory A? **(5 marks)**

ANSWER:

7. An organization surveyed 2 100 randomly chosen students in the province and found that 70% of them enjoyed doing mathematics.

a) Determine the standard error for the sample proportion.

(2 marks)

ANSWER:

- b) Use the results from this sample to find a 95% confidence interval for the actual proportion of students in the province who enjoy doing mathematics. Clearly show the substitution into the confidence interval formula. **(3 marks)**

ANSWER:

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:

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

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

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

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

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

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

Double-Angle Identities:

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

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

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

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

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

Formulae:

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

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

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

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

$$c^2 = a^2 + b^2 - 2ab \cos C$$

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

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

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

A SUMMARY OF BASIC IDENTITIES AND FORMULAE

Probability and Statistics:

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

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

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

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

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

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

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

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

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

$$\mu = np$$

$$\sigma = \sqrt{npq} \quad (q = 1 - p)$$

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

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

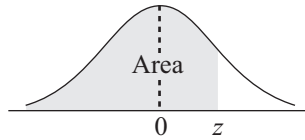
$$\text{standard error} \approx \sqrt{\frac{\hat{p}\hat{q}}{n}}$$

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



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

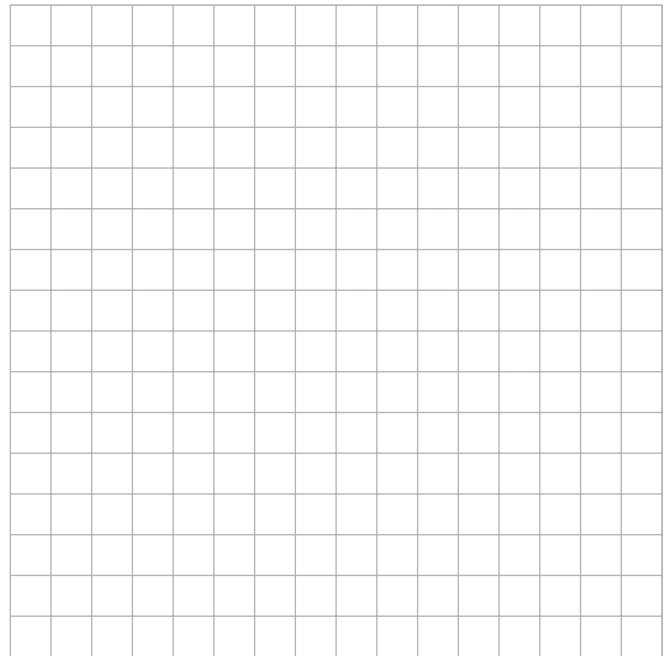
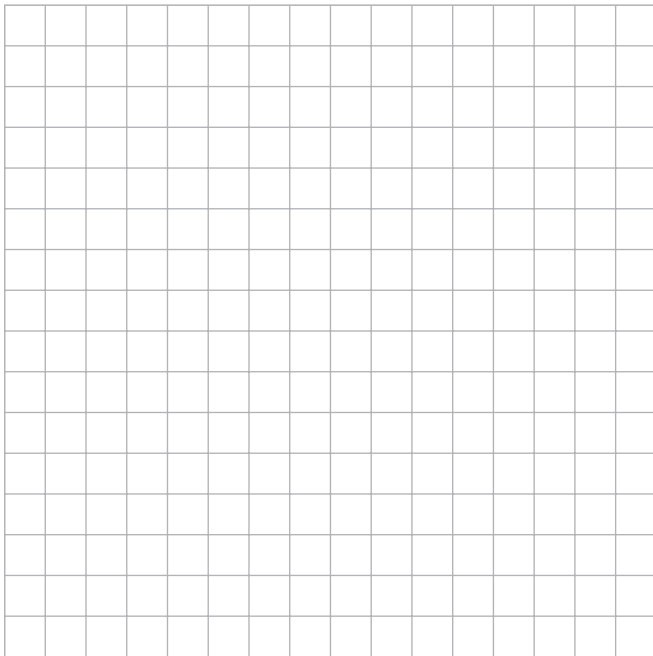
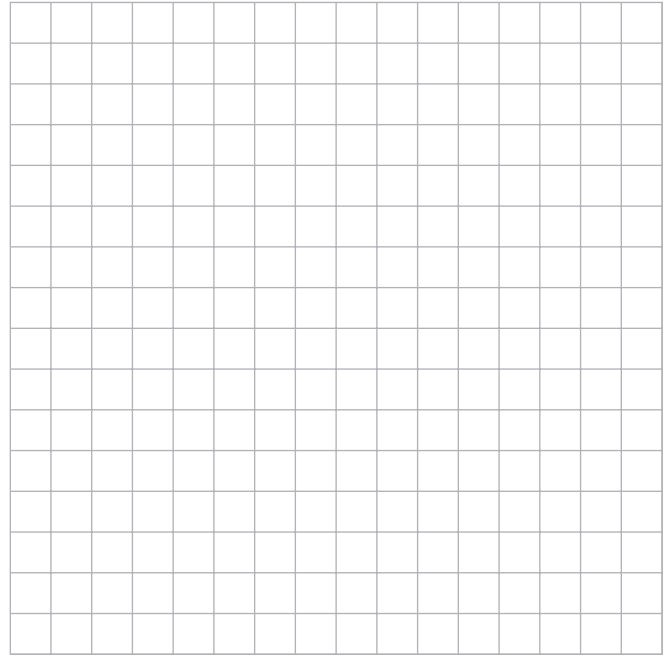
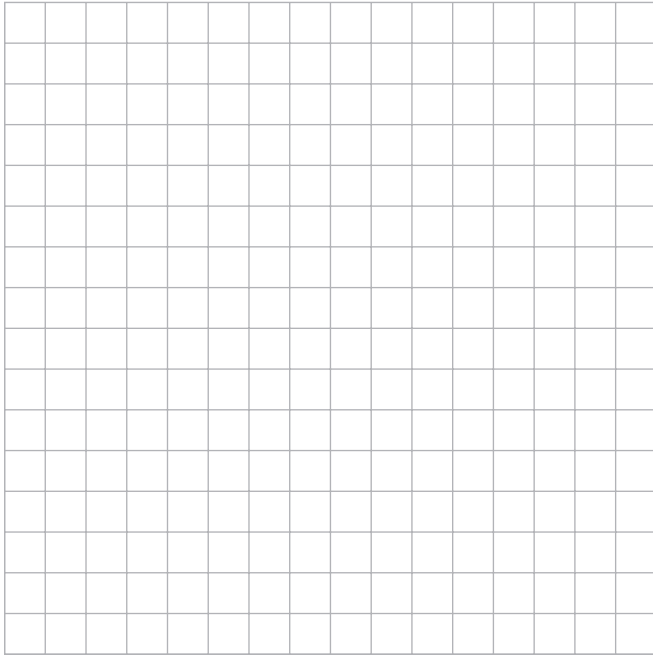
**You may detach this page for convenient reference.
Exercise care when tearing along perforations.**

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

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

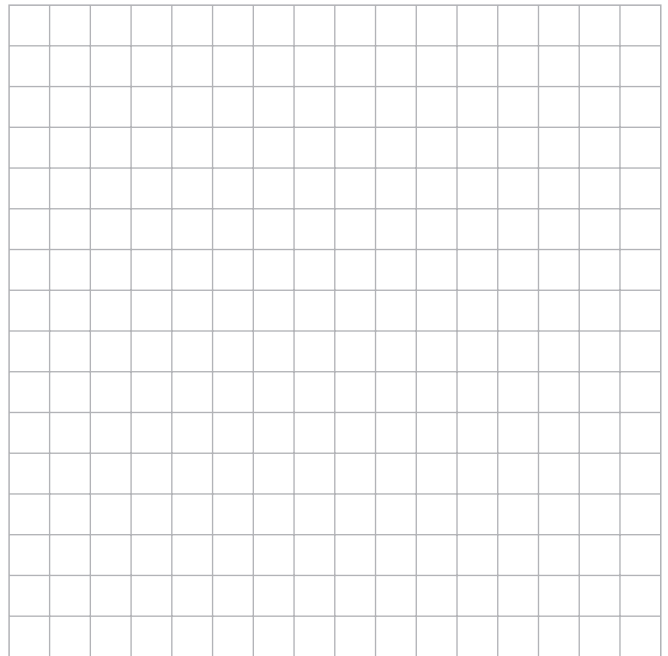
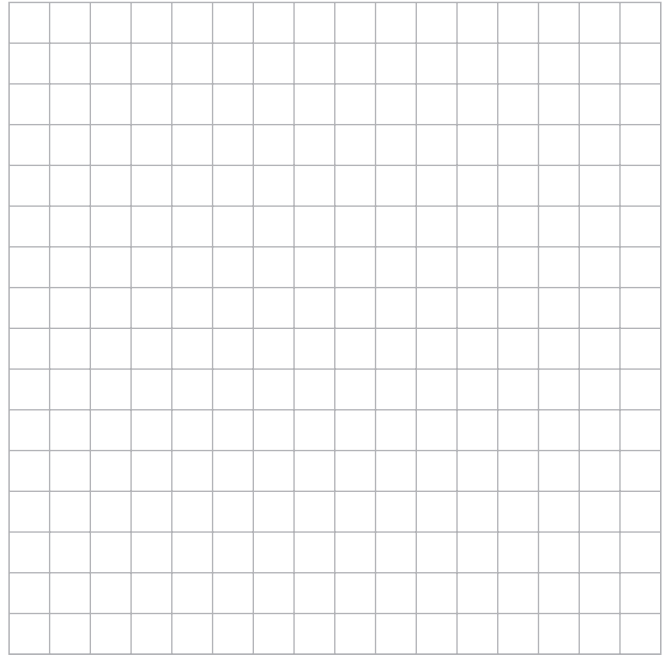
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ROUGH WORK FOR GRAPHING

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ROUGH WORK FOR MULTIPLE-CHOICE

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ROUGH WORK FOR MULTIPLE-CHOICE