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## Principles of Mathematics 12

June 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 5:  
8.  .   
(5)

Question 2a:  
2.  .   
(3)

Question 6a:  
9.  .   
(1)

Question 2b:  
3.  .   
(2)

Question 6b:  
10.  .   
(2)

Question 3:  
4.  .   
(5)

Question 6c:  
11.  .   
(2)

Question 4a:  
5.  .   
(2)

Question 7a:  
12.  .   
(2)

Question 4b:  
6.  .   
(1)

Question 7b:  
13.  .   
(3)

Question 4c:  
7.  .   
(1)



# **PRINCIPLES OF MATHEMATICS 12**

**June 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 <b>two</b> parts: |                         |                    |
| PART A: 44 multiple-choice questions              | 66                      | 75                 |
| PART B: 7 written-response questions              | 34                      | 45                 |
|   | <b>Total: 100 marks</b> | <b>120 minutes</b> |
2. The last **four** pages inside the back cover contain **A Summary of Basic Identities and Formulae, The Standard Normal Distribution Table, Rough Work for Graphing, and Rough Work for Multiple-Choice**. These pages may be detached for convenient reference prior to writing this examination.
3. **A graphing calculator is essential for the Principles of Mathematics 12 Provincial Examination.** The calculator must be a hand-held device designed primarily for mathematical computations involving logarithmic and trigonometric functions, for graphing functions and for performing statistical tests. Computers, calculators with a QWERTY keyboard or symbolic manipulation abilities; such as the Computer Algebraic System (CAS) and electronic writing pads will not be allowed. Students must not bring any external devices (peripherals) to support calculators such as manuals, printed or electronic cards, printers, memory expansion chips or cards, CD-ROMs, libraries or external keyboards. Students may have more than one calculator available during the examination, of which one may be a scientific calculator. Calculators may not be shared and must not have the ability to either transmit or receive electronic signals. In addition to an approved calculator, students will be allowed to use rulers, compasses, and protractors during the examination.
- Calculators must not have any information programmed into the memory which would not be acceptable in paper form.* Specifically, calculators must not have any built-in notes, definitions, or libraries. There is no requirement to clear memories at the beginning of the examination but the use of calculators with built-in notes is equivalent to the use of notes in paper form. Any student deemed to have cheated on a provincial examination will receive a “0” on that examination and will be permanently disqualified from the Provincial Examination Scholarship Program.
4. If, in a justification, you refer to information produced by the graphing calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem, it is important to sketch the graph, showing its general shape and indicating the appropriate values. If the statistical features of the calculator are used, it is important to show the function with the substitution of the relevant numbers. For example: in part of the solution 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. Convert  $210^\circ$  to radians.

- A. 1.83
- B. 2.69
- C. 3.49
- D. 3.67

2. Determine an expression equivalent to  $\sec \theta \cot \theta \sin \theta$ .

- A. 1
- B.  $\cot \theta$
- C.  $\csc \theta$
- D.  $\tan \theta$

3. Determine the exact value of  $\sec \frac{7\pi}{4}$ .

- A.  $-\sqrt{2}$
- B.  $-\frac{1}{\sqrt{2}}$
- C.  $\frac{1}{\sqrt{2}}$
- D.  $\sqrt{2}$

4. Determine the period of the function  $y = 3 \cos 4x$ .

- A.  $\frac{\pi}{2}$
- B.  $\frac{2\pi}{3}$
- C.  $6\pi$
- D.  $8\pi$

5. Determine the range of the function  $y = -2 \sin 3x + 4$ .

- A.  $-6 \leq y \leq -2$
- B.  $-2 \leq y \leq 2$
- C.  $0 \leq y \leq 4$
- D.  $2 \leq y \leq 6$

6. Solve:  $2 \cos x + \sqrt{3} = 0$ ,  $0 \leq x < 2\pi$

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

7. Solve:  $\sin 2x + \cos 3x = 1.5$ ,  $0 \leq x < 2\pi$

- A. 3.84, 4.37
- B. 4.97, 5.12
- C. 5.07, 5.58
- D. 1.20, 1.90, 3.76, 5.64



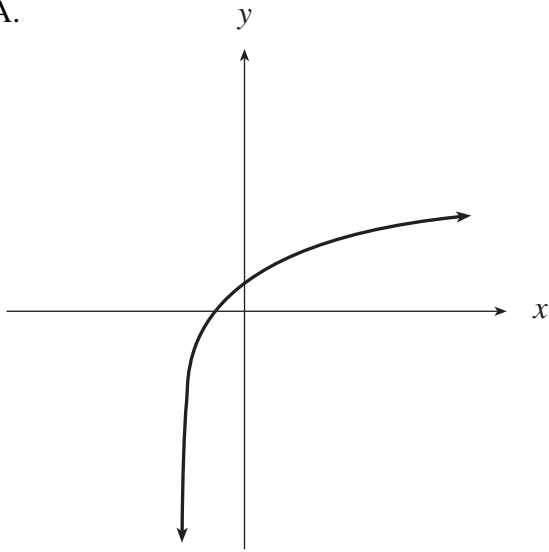
8. Simplify:  $\sin(2x + \pi)$
- A.  $\sin 2x$
  - B.  $\cos 2x$
  - C.  $-\sin 2x$
  - D.  $-\cos 2x$
9. The two smallest positive solutions of  $\sin 3x = 0.4$  are  $x = 0.14$  and  $x = 0.91$ . Determine the general solution of  $\sin 3x = 0.4$ .
- A.  $x = 0.14 + 2n\pi$ ,  $x = 0.91 + 2n\pi$ , ( $n$  is an integer)
  - B.  $x = 0.14 + 6n\pi$ ,  $x = 0.91 + 6n\pi$ , ( $n$  is an integer)
  - C.  $x = 0.14 + \frac{n\pi}{3}$ ,  $x = 0.91 + \frac{n\pi}{3}$ , ( $n$  is an integer)
  - D.  $x = 0.14 + \frac{2n\pi}{3}$ ,  $x = 0.91 + \frac{2n\pi}{3}$ , ( $n$  is an integer)
10. The function  $h(t) = 3.9 \sin 0.16\pi(t - 3) + 6.5$  gives the depth of water,  $h$  metres, at any time,  $t$  hours, during a certain day. A cruise ship needs at least 8 metres of water to dock safely. Use the graph of the function to estimate the number of hours in the 24 hour interval starting at  $t = 0$  during which the cruise ship can dock safely.
- A. 3.79
  - B. 4.68
  - C. 7.57
  - D. 9.36
11. The general term of a geometric sequence is  $t_n = 5(-2)^{n-1}$ . Determine the common ratio.
- A. -5
  - B. -2
  - C. 2
  - D. 5

12. Determine the first term in the expansion of  $\sum_{k=2}^8 3(2^k)$ .
- A. 3
  - B. 6
  - C. 12
  - D. 36
13. Determine the number of terms in the geometric sequence:  $\frac{1}{128}, \frac{1}{32}, \frac{1}{8}, \dots, 2048$
- A. 8
  - B. 9
  - C. 10
  - D. 11
14. Determine the sum of the infinite geometric series:  $3 - 1 + \frac{1}{3} - \frac{1}{9} + \dots$
- A.  $\frac{20}{9}$
  - B.  $\frac{9}{4}$
  - C.  $\frac{9}{2}$
  - D. no finite sum
15. A doctor prescribes medication to be taken for 9 days. The amount taken on the first day is 270 mg. On each successive day, the amount taken is one half the amount taken on the previous day. What is the total amount of medication taken? (Accurate to the nearest mg.)
- A. 538
  - B. 539
  - C. 540
  - D. 541

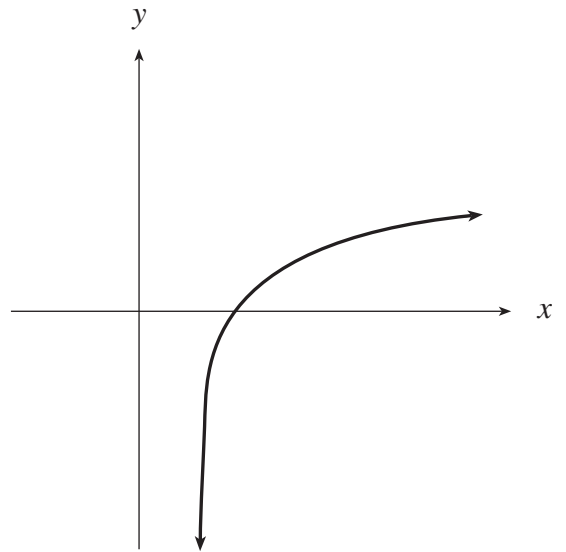
16. Determine the logarithmic form of  $a = b^c$ .
- A.  $\log_a b = c$
  - B.  $\log_a c = b$
  - C.  $\log_c a = b$
  - D.  $\log_b a = c$
17. A recent earthquake in Turkey measured 7.2 on the Richter scale. In 1960, the earthquake in Morocco measured 5.8. How many times as intense was the Moroccan earthquake compared to the recent Turkey earthquake?
- A. 1.24
  - B. 1.4
  - C. 17.43
  - D. 25.12
18. Solve:  $\left(\frac{1}{4}\right)^{1-2x} = 8^{x-3}$
- A. -7
  - B.  $\frac{11}{7}$
  - C.  $\frac{7}{4}$
  - D. no solution
19. If the graph of  $y = \log_a x$  goes through the point (1 024, 5), determine  $a$ .
- A. 4
  - B. 4.31
  - C. 10
  - D. 204.8

20. Which graph best represents the function  $y = \log_2(x - 2)$  ?

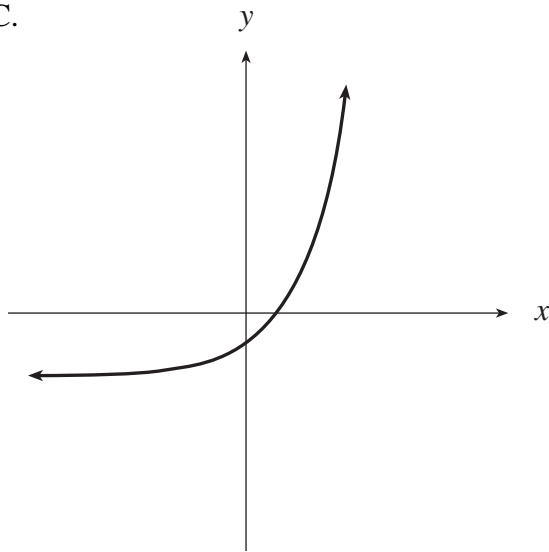
A.



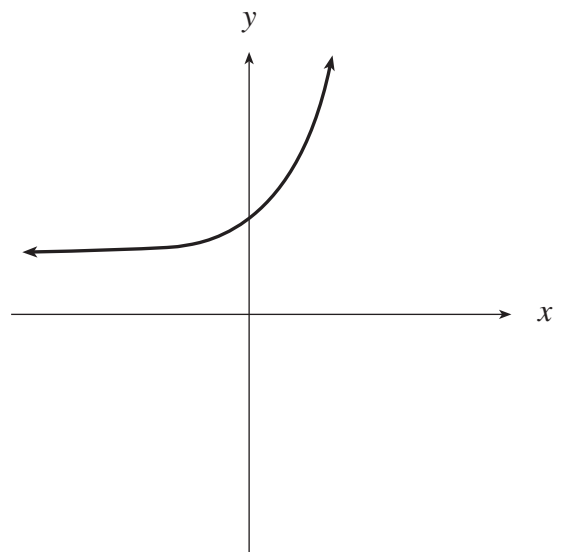
B.



C.



D.



21. A sample of water contains 200 g of pollutants. Each time the sample is passed through a filter, 20% of its pollutants are removed. Determine an expression that gives the number of grams of pollutants still in the water after it passes through five filters.

- A.  $200(0.8)^4$
- B.  $200(1.2)^4$
- C.  $200(0.8)^5$
- D.  $200(1.2)^5$

22. If  $\log_a x = 3$  and  $\log_a y = 4$ , evaluate  $\left(\log_a \frac{1}{xy}\right)^2$ .

- A.  $\frac{1}{49}$
- B. 1
- C. 14
- D. 49

23. Determine the slopes of the asymptotes of  $\frac{x^2}{4} - \frac{y^2}{9} = 1$ .

- A.  $\pm \frac{2}{3}$
- B.  $\pm \frac{3}{2}$
- C.  $\pm \frac{4}{9}$
- D.  $\pm \frac{9}{4}$

**OVER**

24. Determine the vertex of the parabola  $x = -(y + 4)^2 + 3$ .

- A. (3, 4)
- B. (3, -4)
- C. (-4, 3)
- D. (4, 3)

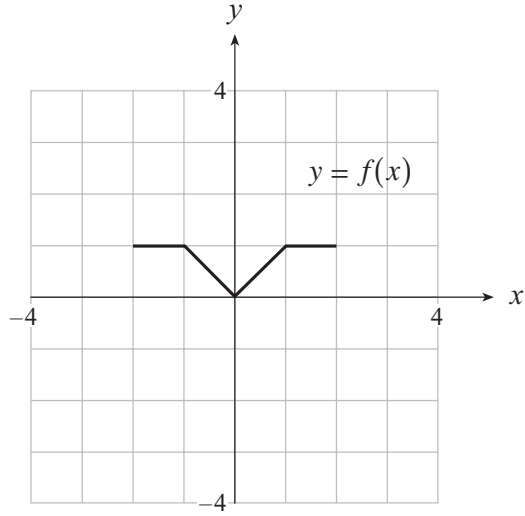
25. Determine the coordinates of the endpoints of the major axis of  $\frac{(x-1)^2}{16} + \frac{(y+2)^2}{25} = 1$ .

- A. (-3, -2), (5, -2)
- B. (-3, 2), (5, 2)
- C. (1, 3), (1, -7)
- D. (1, 7), (1, -3)

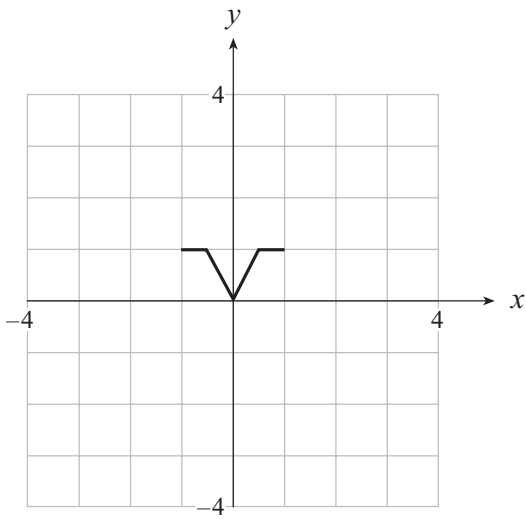
26. The equation  $Ax^2 + By^2 + Cx = 1$  represents an ellipse (not a circle). If  $A > 0$  and  $B > 0$ , what conditions must be satisfied if the ellipse has its major axis on the  $y$ -axis?

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

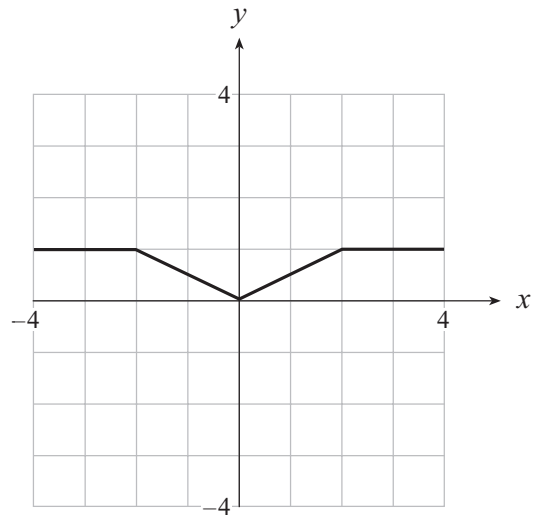
27. Given the graph of  $y = f(x)$ , select the graph of  $y = \frac{1}{2}f(x)$ .



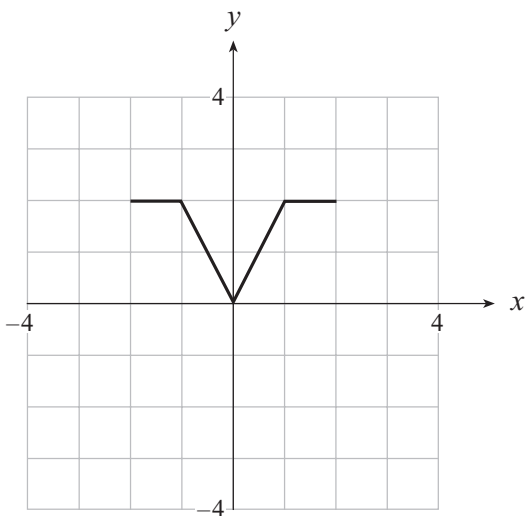
A.



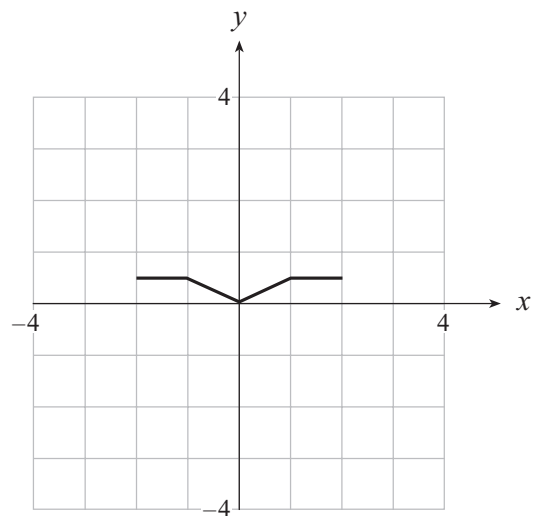
B.



C.



D.

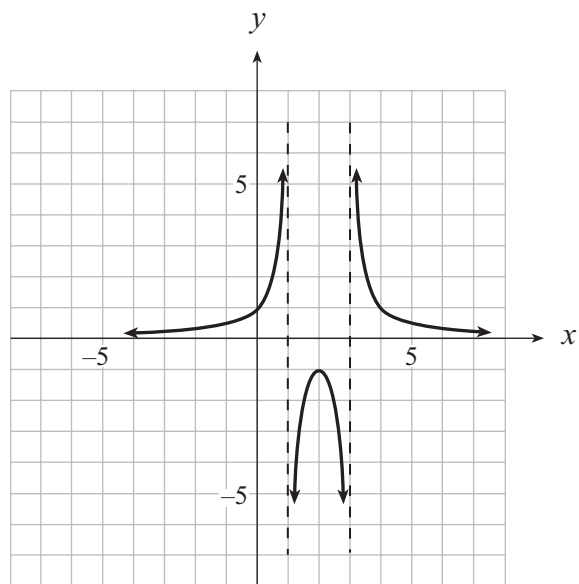
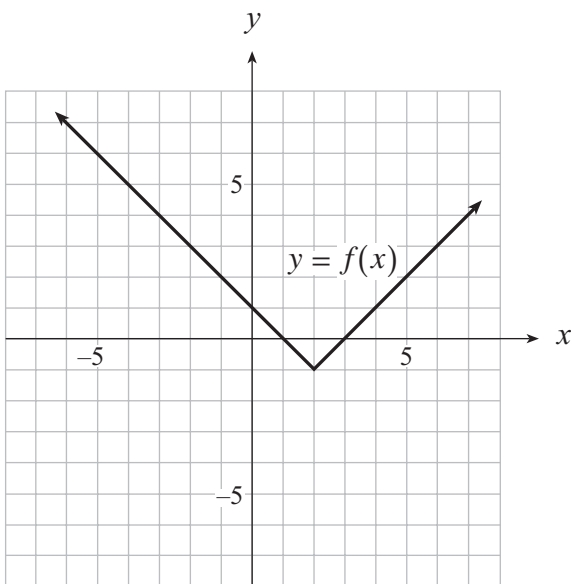


OVER

28. If  $(a, b)$  is a point on the graph of  $y = f(x)$ , determine a point on the graph of  $y = f(x - 2) + 3$ .

- A.  $(a - 2, b + 3)$
- B.  $(a - 2, b - 3)$
- C.  $(a + 2, b + 3)$
- D.  $(a + 2, b - 3)$

29. The graph of  $y = f(x)$  is shown below on the left. Determine the equation of the function shown on the right.

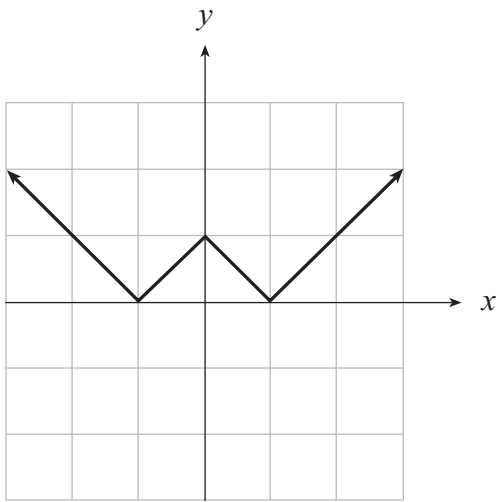


- A.  $y = |f(x)|$
- B.  $y = -f(x)$
- C.  $y = \frac{1}{f(x)}$
- D.  $y = f^{-1}(x)$

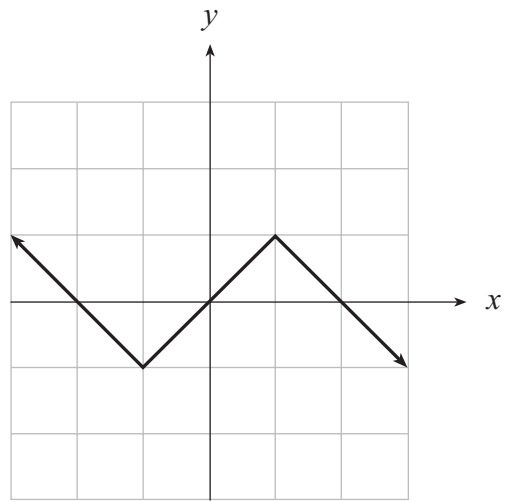


30. For which graph of  $y = f(x)$  would  $f(-x) = -f(x)$  ?

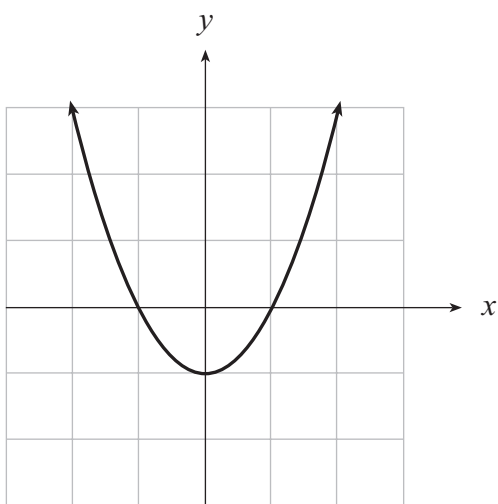
A.



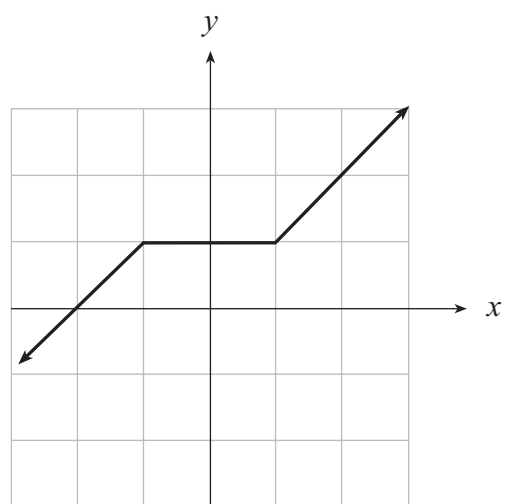
B.



C.

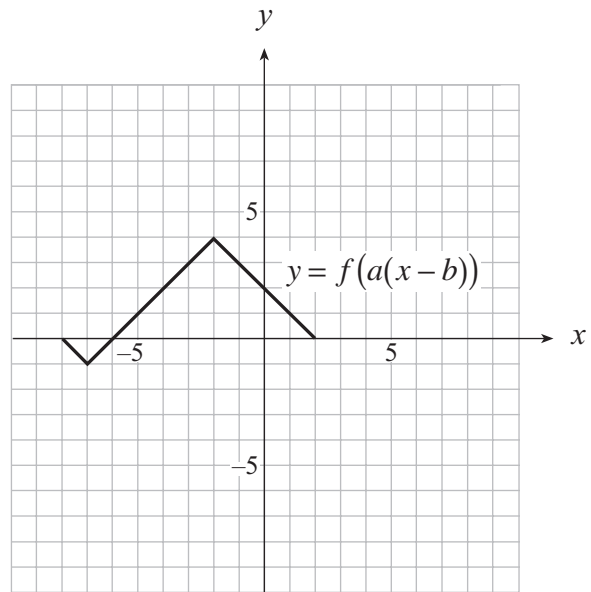
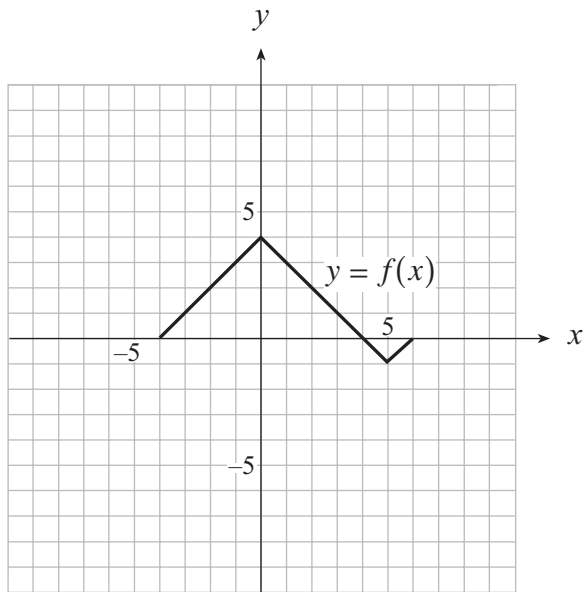


D.



**OVER**

31. Two functions are graphed below,  $y = f(x)$  and  $y = f(a(x-b))$ . Determine the values of  $a$  and  $b$ .



- A.  $a = -1, b = -2$   
 B.  $a = -1, b = 2$   
 C.  $a = 1, b = -2$   
 D.  $a = 1, b = 2$
32. Express  ${}_{33}C_5$  using factorial notation.

- A.  $\frac{33!}{5!}$   
 B.  $\frac{33!}{28!}$   
 C.  $\frac{33!}{5!28!}$   
 D.  $28!$

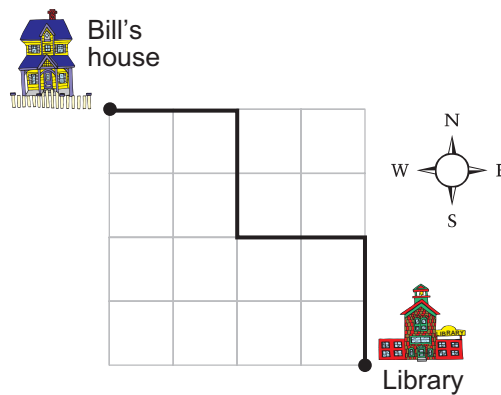
33. Determine the 3<sup>rd</sup> term in the expansion of  $(x - y)^{10}$ .

- A.  $-45x^8y^2$
- B.  $-120x^7y^3$
- C.  $45x^8y^2$
- D.  $120x^7y^3$

34. An experiment consists of tossing a fair coin and rolling a fair die at the same time. Determine the probability of tossing a head and rolling a 1 or a 3.

- A.  $\frac{1}{12}$
- B.  $\frac{1}{5}$
- C.  $\frac{1}{6}$
- D.  $\frac{5}{6}$

35. Bill is walking from his house to the library. If Bill only walks south or east, determine the probability that he will select the route indicated in the diagram below. Assume that all routes have an equal chance of being chosen.

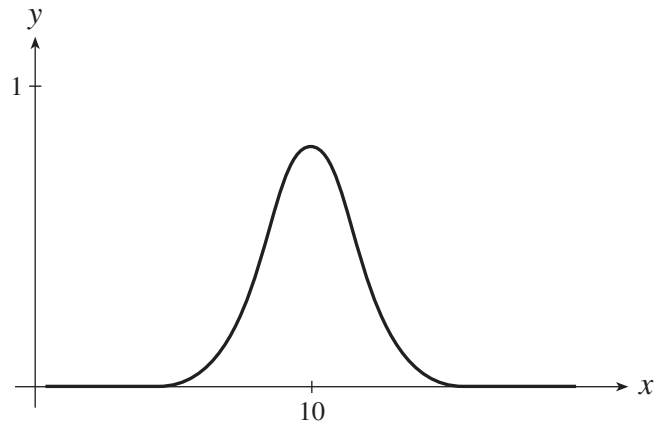
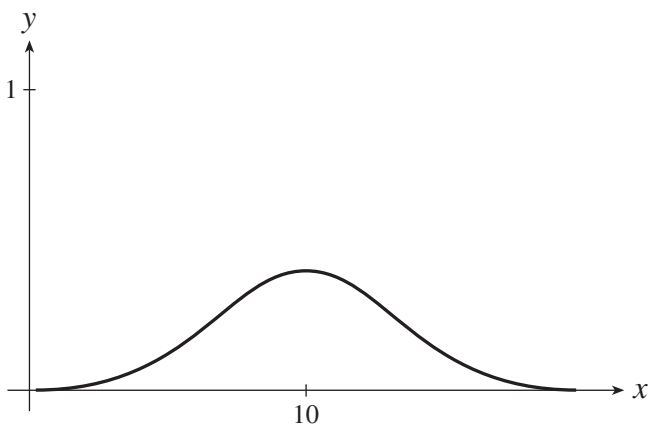


- A.  $\frac{1}{20}$
- B.  $\frac{1}{35}$
- C.  $\frac{1}{55}$
- D.  $\frac{1}{70}$

36. If a fair coin is tossed four times, what is the probability of obtaining at least one head?

- A.  $\frac{1}{16}$
- B.  $\frac{3}{4}$
- C.  $\frac{7}{8}$
- D.  $\frac{15}{16}$

Use the following diagrams to answer question 37.



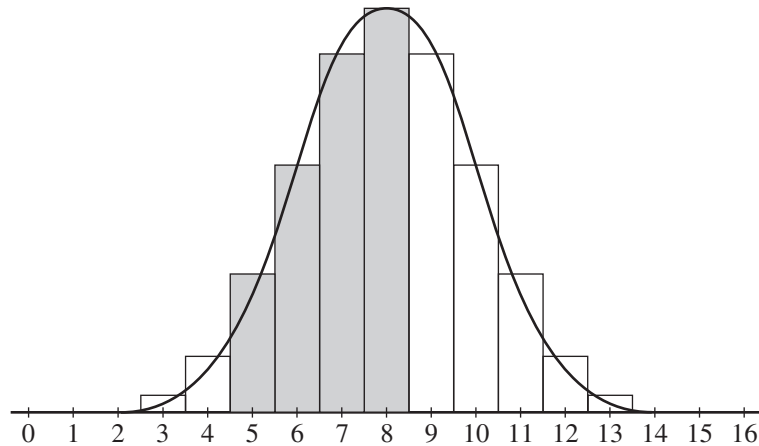
37. Which statement below best describes the properties of the two normal distributions graphed in the diagrams above?

- A. The means are the same and the standard deviations are the same.
- B. The means are the same and the standard deviations are different.
- C. The means are different and the standard deviations are the same.
- D. The means are different and the standard deviations are different.

38. Determine the standard deviation for the following population of golf scores: 75, 78, 67, 68, 74, 70

- A. 3.96
- B. 4.56
- C. 8.26
- D. 72

39. The normal approximation is used to estimate the area shown in the binomial distribution below. Which of the following probability statements gives the most appropriate approximation of the area?

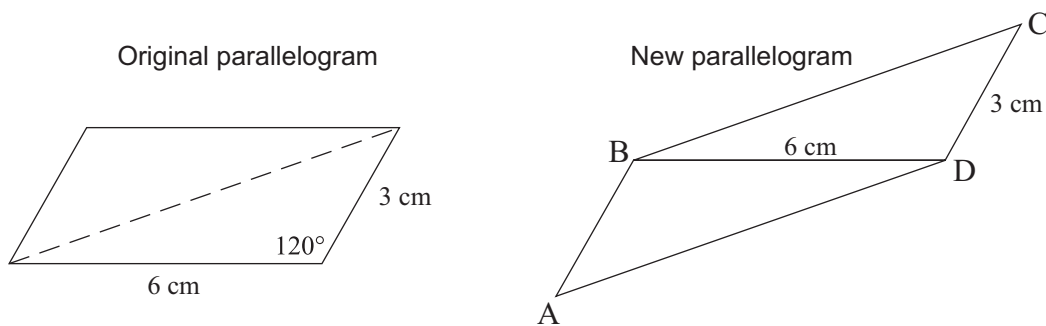


- A.  $P(4.5 < X < 8.5)$   
 B.  $P(5.5 < X < 8.5)$   
 C.  $P(5.5 < X < 7.5)$   
 D.  $P(4.5 < X < 7.5)$
40. The results for a test are normally distributed. The mean score is 67 with a standard deviation of 9. If the top 10% of the students receive an “A”, what is the minimum mark needed to receive an “A”? (Accurate to the nearest integer.)
- A. 55  
 B. 79  
 C. 86  
 D. 90
41. Tomatoes chosen at random have a mean mass of 200 grams and standard deviation of 50 grams. Assuming a normal distribution, what is the probability of choosing a tomato with a mass between 100 grams and 250 grams?
- A. 0.819  
 B. 0.841  
 C. 0.955  
 D. 0.977

42. Simplify:  $e^{\ln a}$

- A.  $a$
- B.  $e^a$
- C.  $\ln a$
- D.  $ae$

43. A parallelogram has sides 3 cm and 6 cm and an angle of  $120^\circ$ , as shown. It is cut along its long diagonal to form two triangles. The triangles are placed so that the sides of length 6 cm are together, forming a new parallelogram, ABCD, as shown. Determine the exact length of the diagonal, AC, of this new parallelogram.



- A. 6
- B.  $6\sqrt{3}$
- C. 12
- D.  $12\sqrt{3}$

44. In the sequence  $t_n = \sum_{k=1}^n x^{k-1} + \sum_{k=1}^n (-x)^{k-1}$ , determine an expression for  $t_4$ .

- A. 0
- B.  $2x^3$
- C.  $2x^2 + 2$
- D.  $2x^3 + 2x^2 + 2x + 2$

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

## PART B: WRITTEN RESPONSE

Value: 34 marks

Suggested Time: 45 minutes

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

If, in a justification, you refer to information produced by the graphing calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem, it is important to sketch the graph, showing its general shape and indicating the appropriate values. If the statistical features of the calculator are used, it is important to show the function with the substitution of the relevant numbers. For example: in part of the solution 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.**

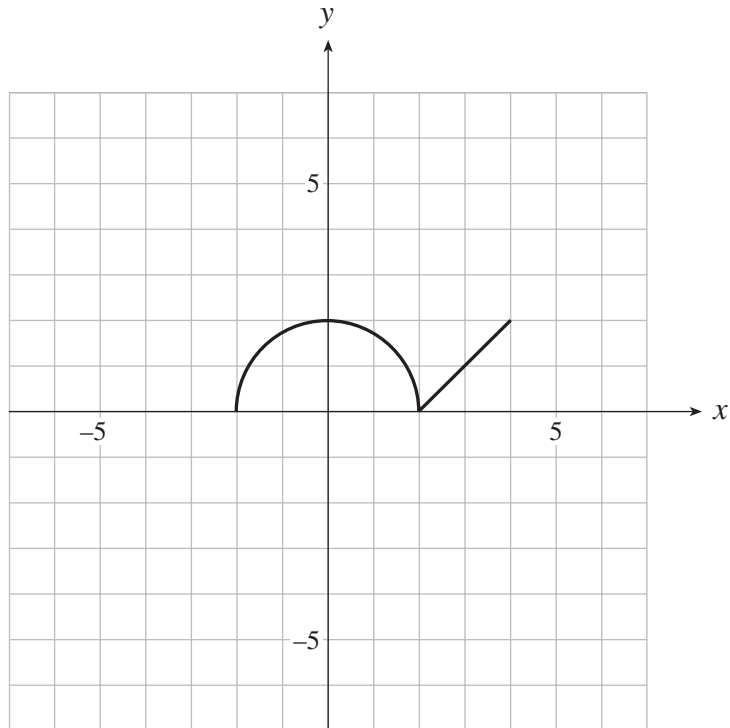
1. Solve algebraically:  $\log_2 x + \log_2(x - 7) = 3$

**(5 marks)**



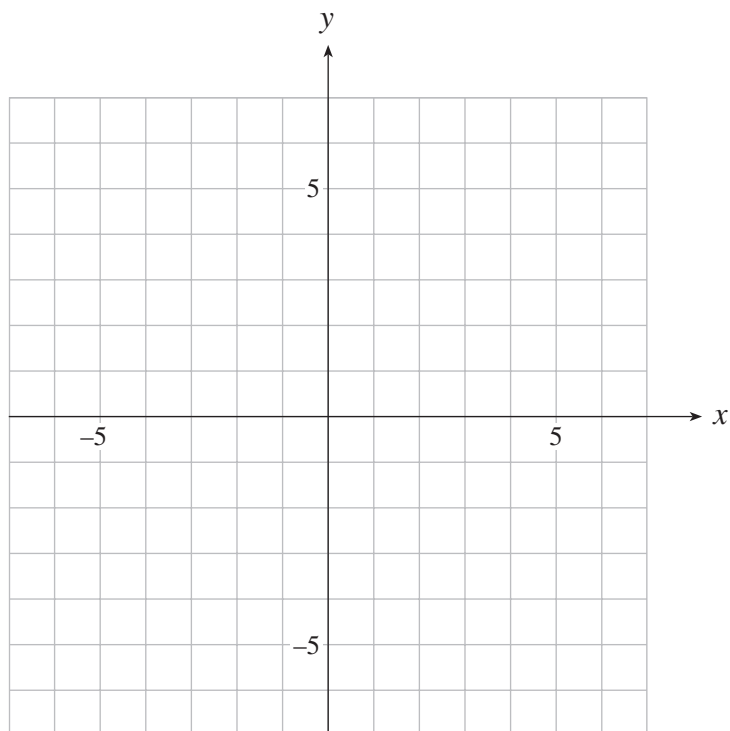
ANSWER:

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



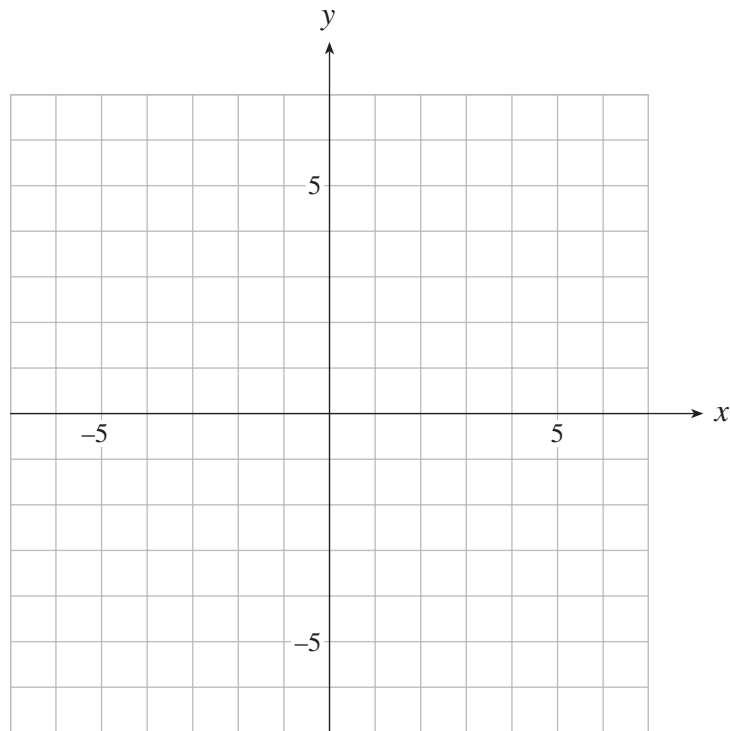
a) Graph  $y = 2f(x + 3) - 1$  on the grid provided.

**(3 marks)**



b) Graph the inverse relation of  $y = f(x)$ .

(2 marks)



3. Change to standard form:  $4y^2 + 16y - 9x^2 + 18x - 29 = 0$

**(5 marks)**

ANSWER:

4. A class has 30 students.

a) How many ways can a committee of 3 people be selected from the class? **(2 marks)**

ANSWER:

b) How many ways can an executive committee consisting of 3 people (president, vice-president, secretary) be selected from the class? **(1 mark)**

ANSWER:

- c) If there are 10 boys and 20 girls in the class, how many ways can a committee of 3 people be selected from the class if the committee must contain 1 boy and 2 girls? **(1 mark)**

ANSWER:

**OVER**

5. Prove the identity:

(5 marks)

$$\sin 2x(\tan x + \cot x) = 2$$

LEFT SIDE	RIGHT SIDE





6. The probability of winning a game is 0.7. You play 3 games. (Answer all parts of the question accurate to at least 3 decimal places.)

a) What is the probability that you win all 3 games?

**(1 mark)**

ANSWER:

b) What is the probability that you win at least twice?

**(2 marks)**

ANSWER:

c) If you win at least twice, what is the probability that you have 3 wins?

**(2 marks)**

ANSWER:

**OVER**

7. The Bullock and Brown organization surveyed 400 randomly chosen BC residents and found that 20% of the respondents have cellular phones.

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 BC residents who have cellular phones. 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:

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

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

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

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

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

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

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

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## A SUMMARY OF BASIC IDENTITIES AND FORMULAE

### Probability and Statistics:

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

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

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

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

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

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

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

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

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

$$\mu = np$$

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

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

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

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

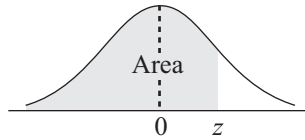
$$\hat{p} - z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}} < p < \hat{p} + z_{\frac{\alpha}{2}} \sqrt{\frac{\hat{p}\hat{q}}{n}}$$



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

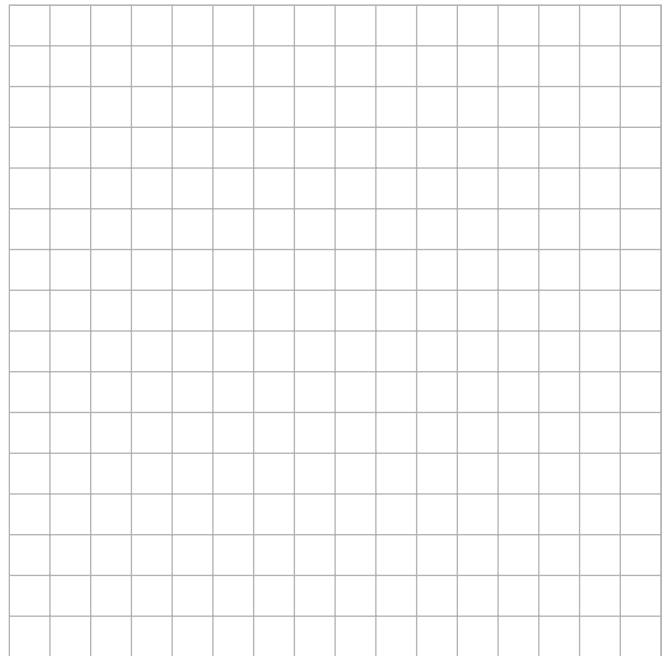
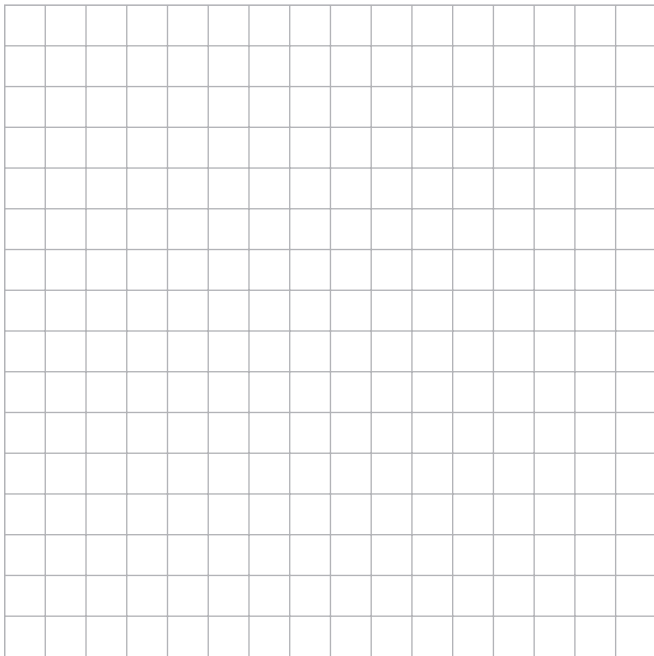
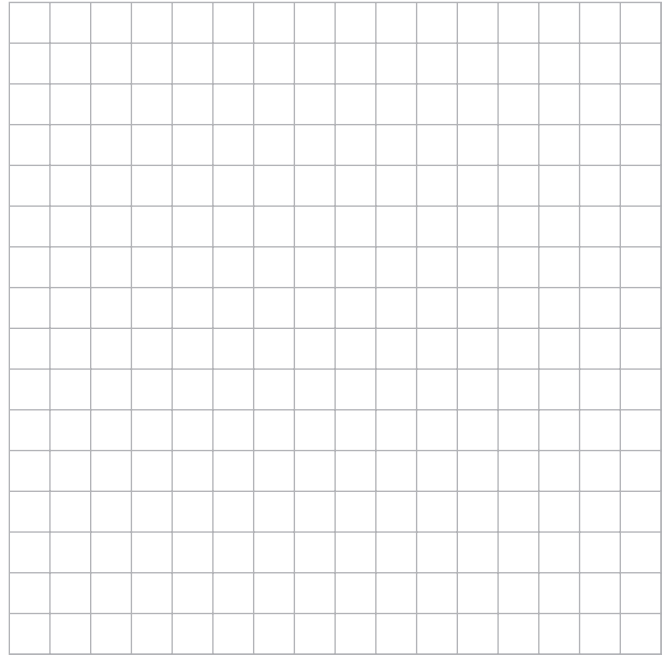
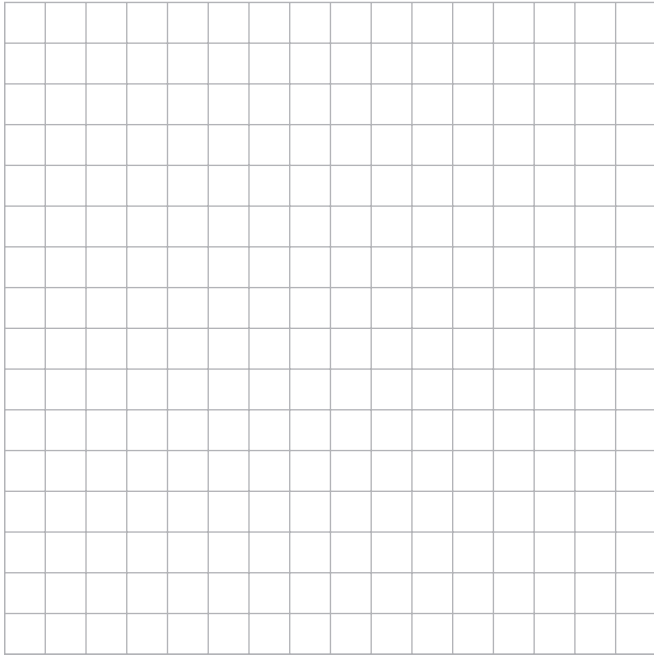
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$$F_z(z) = P[Z \leq z]$$

$z$	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.08</b>	<b>0.09</b>
0.0	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
0.1	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
0.2	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
0.3	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
0.4	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
0.5	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
0.6	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
0.7	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
0.8	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
0.9	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
1.0	0.8413	0.8438	0.8461	0.8485	0.8508	0.8531	0.8554	0.8577	0.8599	0.8621
1.1	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
1.2	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
1.3	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9131	0.9147	0.9162	0.9177
1.4	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9278	0.9292	0.9306	0.9319
1.5	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
1.6	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
1.7	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
1.8	0.9641	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
1.9	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9750	0.9756	0.9761	0.9767
2.0	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
2.1	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
2.2	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
2.3	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916
2.4	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
2.5	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
2.6	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
2.7	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
2.8	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
2.9	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
3.0	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
3.1	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
3.2	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
3.3	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
3.4	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

# ROUGH WORK FOR GRAPHING

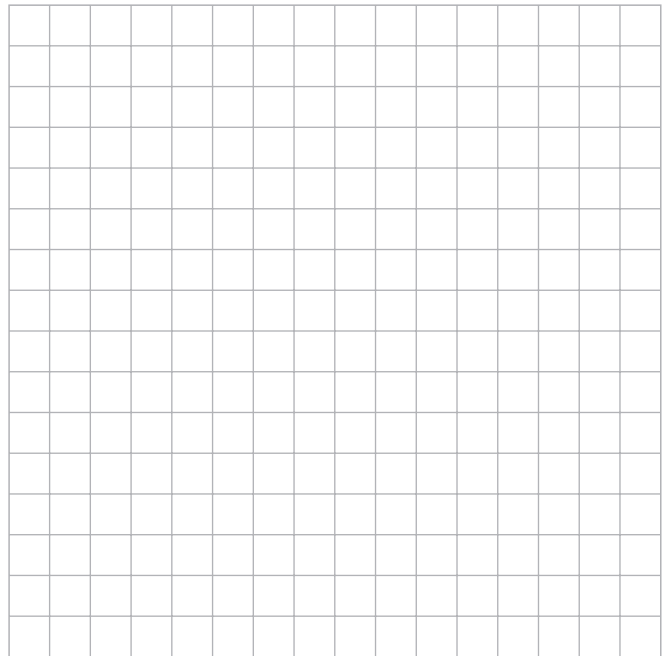
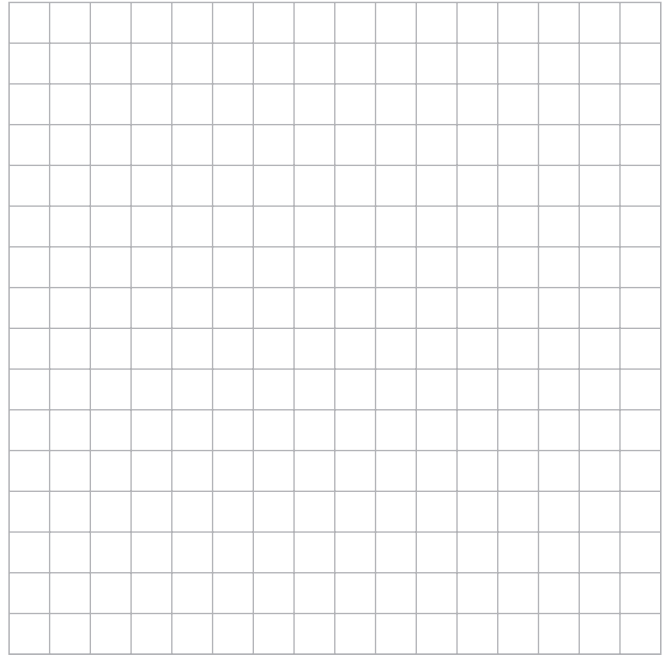
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## **ROUGH WORK FOR MULTIPLE-CHOICE**