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Principles of Mathematics 12

June 2004

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.

<p>Question 1a</p> <p>0 1 2</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Question 1b</p> <p>0 1 2 3</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Question 2</p> <p>0 1 2 3 4</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Question 3</p> <p>0 1 2 3 4 5</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Question 4</p> <p>0 1 2 3 4</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Question 5a</p> <p>0 1 2</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Question 5b</p> <p>0 1 2</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Question 6</p> <p>0 1 2 3 4</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>
<p>Question 7</p> <p>0 1 2 3 4</p> <p><input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/></p>	<p>▪ (5) NR</p> <p><input type="checkbox"/> <input type="checkbox"/></p>

PRINCIPLES OF MATHEMATICS 12

June 2004

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. Rough-work space has been incorporated into the space allowed for answering each written-response 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: 40 multiple-choice questions | 60 marks | 75 minutes |
| PART B: 7 written-response questions | 30 marks | 45 minutes |
| | Total: 90 marks | 120 minutes |
2. The last **four** pages inside the back cover contain **A Summary of Basic Identities and Formulae, The Standard Normal Distribution Table, Rough Work for Graphing, and Rough Work for Multiple-Choice**. These pages may be detached for convenient reference prior to writing this examination.
3. **A graphing calculator is essential for the Principles of Mathematics 12 Provincial Examination.** The calculator must be a hand-held device designed primarily for mathematical computations involving logarithmic and trigonometric functions, for graphing functions and for performing statistical tests. Computers, calculators with a QWERTY keyboard or symbolic manipulation abilities such as the Computer Algebraic System (CAS) and electronic writing pads will not be allowed. Students must not bring any external devices (peripherals) to support calculators such as manuals, printed or electronic cards, printers, memory expansion chips or cards, CD-ROMs, libraries or external keyboards. Students may have more than one calculator available during the examination, of which one may be a scientific calculator. Calculators may not be shared and must not have the ability to either transmit or receive electronic signals. In addition to an approved calculator, students will be allowed to use rulers, compasses, and protractors during the examination.
- Calculators must not have any information programmed into the memory which would not be acceptable in paper form.* Specifically, calculators must not have any built-in notes, definitions, or libraries. There is no requirement to clear memories at the beginning of the examination but the use of calculators with built-in notes is equivalent to the use of notes in paper form. Any student deemed to have cheated on a provincial examination will receive a “0” on that examination and will be permanently disqualified from the Provincial Examination Scholarship Program.
4. If, in a justification, you refer to information produced by the graphing calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem it is important to sketch the graph, showing its general shape and indicating the appropriate values. If the statistical features of the calculator are used, it is important to show the function with the substitution of the relevant numbers. For example: in part of the solution it is acceptable to show $\text{normalcdf}(10, 40, 50, 20)$ or the equivalent syntax for the calculator used.
5. When using the calculator, you should provide a decimal answer that is correct to **at least two decimal places** (unless otherwise indicated). Such rounding should occur **only** in the final step of the solution.

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PART A: MULTIPLE CHOICE

Value: 60 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 on the Response Form that has the letter corresponding to your answer.

1. Determine the exact value of $\cos \frac{7\pi}{4}$.

A. $\frac{1}{\sqrt{2}}$

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

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

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

2. In a circle with radius 12 cm an arc of length 20 cm subtends a central angle of θ . Determine the measure of θ in radians.

A. 0.60

B. 1.20

C. 1.67

D. 3.33

3. Solve: $7 \tan x = -3$, $0 \leq x < 2\pi$

A. 2.74, 3.55

B. 2.74, 5.88

C. 0.40, 3.55

D. 0.40, 5.88

OVER

4. Give the period of $f(x) = 3 \csc x$.
- $\frac{\pi}{3}$
 - π
 - 2π
 - 3π
5. Determine an expression equivalent to $\tan^2 \theta \csc \theta + \frac{1}{\sin \theta}$.
- $\sec^3 \theta$
 - $\csc^3 \theta$
 - $\csc^2 \theta \sec \theta$
 - $\sec^2 \theta \csc \theta$
6. Solve over the set of real numbers: $2 \sin^2 x - 5 \sin x - 3 = 0$
- $\frac{\pi}{6} + n\pi, \frac{5\pi}{6} + n\pi, n$ is an integer
 - $\frac{7\pi}{6} + n\pi, \frac{11\pi}{6} + n\pi, n$ is an integer
 - $\frac{\pi}{6} + 2n\pi, \frac{5\pi}{6} + 2n\pi, n$ is an integer
 - $\frac{7\pi}{6} + 2n\pi, \frac{11\pi}{6} + 2n\pi, n$ is an integer
7. Let θ be an angle in standard position such that $\tan \theta = \frac{2}{3}$ and $\sin \theta < 0$. Determine the exact value of $\sec \theta$.
- $-\frac{\sqrt{13}}{2}$
 - $-\frac{\sqrt{13}}{3}$
 - $\frac{\sqrt{13}}{3}$
 - $\frac{\sqrt{13}}{2}$

8. Determine an expression equivalent to $\cos(\pi + 2A)$.

- A. $-\cos 2A$
- B. $\cos 2A$
- C. $-\sin 2A$
- D. $\sin 2A$

9. For the function $f(x) = 3 \sin bx + d$ where b and d are positive constants, determine an expression for the smallest positive value of x that produces the maximum value of $f(x)$.

- A. $\frac{2\pi}{b}$
- B. $\frac{\pi}{2b}$
- C. $\frac{4\pi}{b}$
- D. $\frac{\pi}{4b}$

10. Determine the 9th term of the geometric sequence $\frac{1}{20}, \frac{1}{5}, \frac{4}{5}, \dots$

- A. 3 276.80
- B. 13 107.20
- C. 19 531.25
- D. 97 656.25

11. Evaluate: $\sum_{k=1}^8 5(3)^k$

- A. 5 465
- B. 16 395
- C. 16 400
- D. 49 200

12. Which infinite geometric series has a finite sum?

- A. $\frac{1}{2} - 1 + 2 - 4 + \dots$
- B. $64 + 48 + 36 + 27 + \dots$
- C. $\frac{1}{24} + \frac{1}{12} + \frac{1}{6} + \frac{1}{3} + \dots$
- D. $16 - 20 + 25 - 31.25 + \dots$

13. Determine a value of k for the geometric sequence: 8, k , 20

- A. $\frac{\sqrt{10}}{2}$
- B. $2\sqrt{10}$
- C. $4\sqrt{5}$
- D. $4\sqrt{10}$

14. A new well produces 48 000 L of water in the first month. If the volume of water pumped decreases by 6% each month, determine the total volume of water, in litres, that will be pumped from the well before it runs dry.

- A. 51 063.83
- B. 93 120
- C. 752 000
- D. 800 000

15. Give the domain of $f(x) = \log_7(x + 6) + 12$.

- A. $x > 6$
- B. $x > -6$
- C. $x > 12$
- D. $x > -12$

16. Express $\log_5 30$ using logarithms in base 4.

A. $\log_4 30 - \log_4 5$

B. $\frac{\log_4 5}{\log_4 30}$

C. $\frac{\log_4 30}{\log_4 5}$

D. $\frac{\log_{30} 4}{\log_5 4}$

17. Solve: $\left(\frac{1}{9}\right)^x = 27^{2-x}$

A. -6

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

C. 2

D. 6

18. Which expression is equivalent to $\log \frac{x}{2y^3}$?

A. $\log x - \log 2 + 3 \log y$

B. $\log x - 3 \log 2 + 3 \log y$

C. $\log x - \log 2 - 3 \log y$

D. $\log x - 3 \log 2 - 3 \log y$

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

A. 2.37

B. 3

C. 3.37

D. 3.5

OVER

20. The formula $A = P(1.09)^t$ is an example of exponential growth with base 1.09. Determine an equivalent continuous growth formula using base e , $A = Pe^{kt}$.
- A. $A = Pe^{0.086t}$
 - B. $A = Pe^{1.086t}$
 - C. $A = Pe^{0.86t}$
 - D. $A = Pe^{1.86t}$

21. Determine an exponential function in the form $y = 3^{x-h} + k$ with y-intercept 5 and asymptote $y = -4$.
- A. $y = 3^{x-4} + 5$
 - B. $y = 3^{x-2} - 4$
 - C. $y = 3^{x-5} - 4$
 - D. $y = 3^{x+2} - 4$

22. Determine the radius of the circle: $x^2 + y^2 = 16$
- A. 4
 - B. 8
 - C. 16
 - D. 256

23. Change to standard form: $x^2 + 2y^2 + 16y - 36 = 0$
- A. $\frac{x^2}{68} + \frac{(y+4)^2}{34} = 1$
 - B. $\frac{x^2}{4} + \frac{(y+4)^2}{2} = 1$
 - C. $\frac{x^2}{52} + \frac{(y+4)^2}{26} = 1$
 - D. $\frac{x^2}{20} + \frac{(y+4)^2}{10} = 1$

24. Determine an equation of the hyperbola that has centre $(3, -2)$, a vertex $(9, -2)$ and an asymptote $2x - 3y = 12$.

A. $\frac{(x-3)^2}{6} - \frac{(y+2)^2}{4} = 1$

B. $\frac{(x-3)^2}{6} - \frac{(y+2)^2}{9} = 1$

C. $\frac{(x-3)^2}{36} - \frac{(y+2)^2}{16} = 1$

D. $\frac{(x-3)^2}{36} - \frac{(y+2)^2}{81} = 1$

25. Which equation represents the graph of $y = \tan x$ after it has been translated 4 units up and 7 units left?

A. $y = \tan(x + 7) + 4$

B. $y = \tan(x + 7) - 4$

C. $y = \tan(x - 7) + 4$

D. $y = \tan(x - 7) - 4$

26. Determine an equation of the inverse of $f(x) = 2x + 6$.

A. $f^{-1}(x) = \frac{1}{2}x - 3$

B. $f^{-1}(x) = \frac{1}{2x+6}$

C. $f^{-1}(x) = -2x - 6$

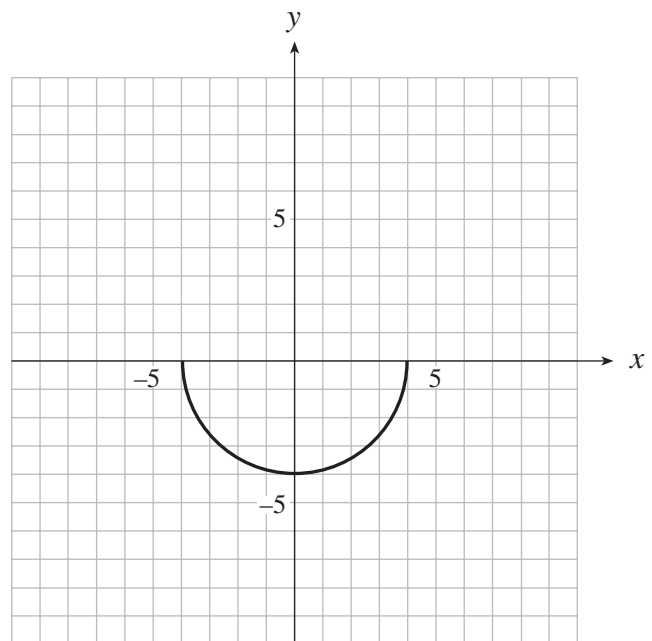
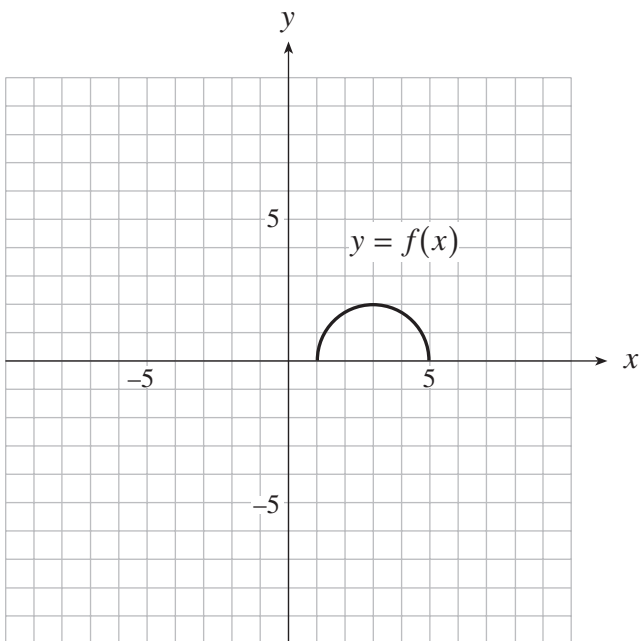
D. $f^{-1}(x) = \frac{1}{2}x + \frac{1}{6}$

27. The point $(9, -12)$ is on the graph of a function. What will the coordinates of this point be after all of the following transformations are performed on the function, in the order given?

- horizontal expansion by a factor of 3
- reflection in the x -axis
- vertical translation of 5 downward
- reflection in the line $y = x$

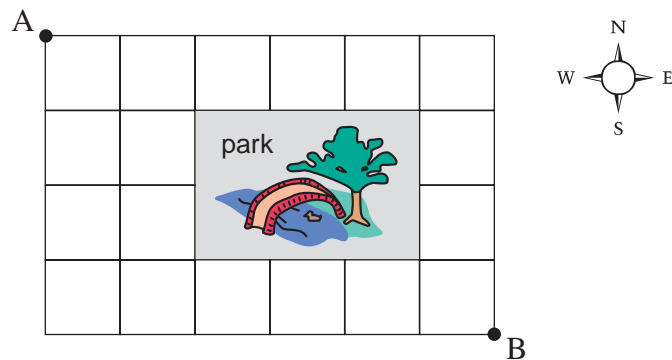
- A. $(-27, 7)$
 B. $(-17, -27)$
 C. $(7, 3)$
 D. $(7, 27)$

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



- A. $y = -2f(2x + 3)$
 B. $y = -2f(2x + 6)$
 C. $y = -2f\left(\frac{1}{2}x + 3\right)$
 D. $y = -2f\left(\frac{1}{2}x + 6\right)$

29. A student has 7 different textbooks. Which expression gives the number of different ways 4 of these books can be selected and arranged on a shelf?
- A. $4!$
 B. $\frac{7!}{4!}$
 C. 7C_4
 D. 7P_4
30. Determine the 8th term in the expansion of $(2x - y)^{11}$.
- A. $-5280x^4y^7$
 B. $-2640x^4y^7$
 C. $1320x^3y^8$
 D. $990x^3y^8$
31. The diagram below represents a street map. If a person can only travel east or south on the streets, how many different routes are there from A to B?



- A. 60
 B. 68
 C. 80
 D. 200

Use the following information to answer questions 32 and 33.

The winner of a lottery chooses 4 vehicles from a warehouse that contains 12 different cars, 8 different trucks, and 5 different motorcycles.

32. How many different choices of 4 vehicles are possible?

- A. 480
- B. 570
- C. 12 650
- D. 303 600

33. How many different choices of 4 vehicles are possible if there must be at least one car?

- A. 1 171
- B. 3 432
- C. 9 218
- D. 11 935

34. If a fair six-sided die is tossed twice, what is the probability that the first toss will be a number less than 3 and the second toss will be a number more than 3?

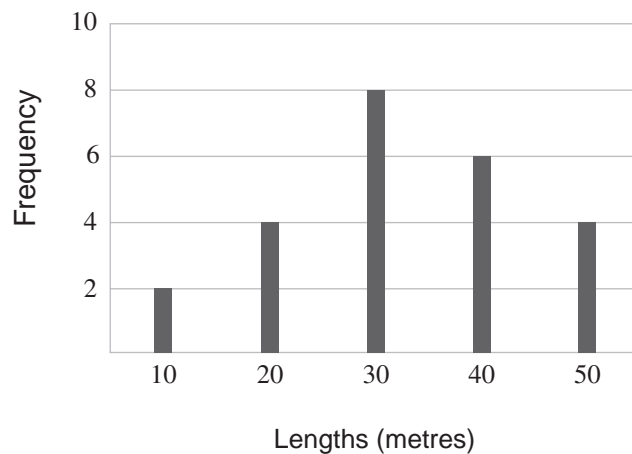
- A. $\frac{1}{9}$
- B. $\frac{1}{6}$
- C. $\frac{1}{4}$
- D. $\frac{5}{6}$

35. If 5 cards are dealt from a standard deck of 52 cards, determine the probability of obtaining 3 red cards and 2 black *face* cards.

- A. 0.0010
- B. 0.0150
- C. 0.0660
- D. 0.3251

36. A biased coin is designed so that it comes up heads 65% of the time. If this coin is tossed 7 times, determine the probability of obtaining exactly 5 heads.
- A. 0.0466
B. 0.2985
C. 0.4643
D. 0.7662
37. A bag contains 4 yellow balls and n red balls. Two balls are drawn from the bag, one after the other, without replacement. Which expression represents the probability that one ball is yellow and one ball is red?
- A. $\left(\frac{4}{n+4}\right)\left(\frac{n-1}{n+3}\right) + \left(\frac{n-1}{n+4}\right)\left(\frac{3}{n+3}\right)$
B. $\left(\frac{4}{n+4}\right)\left(\frac{n}{n+3}\right) + \left(\frac{n}{n+4}\right)\left(\frac{4}{n+3}\right)$
C. $\left(\frac{4}{n+4}\right)\left(\frac{n}{n+3}\right) + \left(\frac{n-1}{n+4}\right)\left(\frac{3}{n+3}\right)$
D. $\left(\frac{4}{n+4}\right)\left(\frac{3}{n+3}\right) + \left(\frac{n}{n+4}\right)\left(\frac{4}{n+3}\right)$
38. The volumes of ketchup in bottles are normally distributed with a mean of 375 mL and a standard deviation of 2 mL. What proportion of the bottles contain between 372 mL and 376 mL?
- A. 0.62
B. 0.67
C. 0.73
D. 0.82

39. Determine the standard deviation in metres of the population of lengths represented in the frequency distribution below.



- A. 11.23
B. 11.56
C. 11.64
D. 11.97
40. Weight losses from a particular diet are normally distributed with a standard deviation of 1.2 kg. If 58% of the weight losses are 6.5 kg or more, determine the mean weight loss.
- A. 6.3
B. 6.7
C. 7.0
D. 7.1

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

PART B: WRITTEN RESPONSE

Value: 30 marks

Suggested Time: 45 minutes

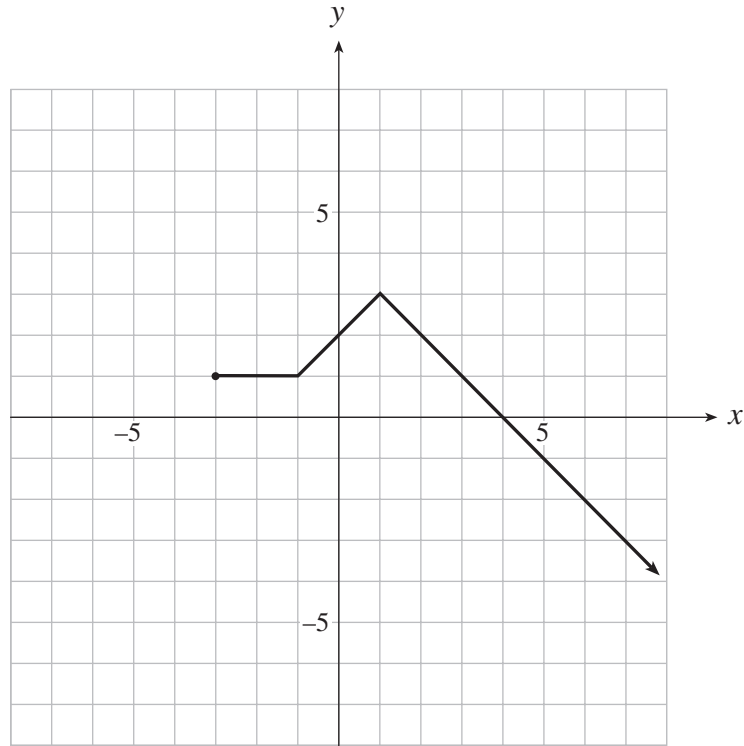
INSTRUCTIONS: Rough-work space has been incorporated into the space allowed for answering each question. You may not need all the space provided to answer each question. Where required, place the final answer for each question in the space provided.

If, in a justification, you refer to information produced by the graphing calculator, this information must be presented clearly in the response. For example, if a graph is used in the solution of the problem it is important to sketch the graph, showing its general shape and indicating the appropriate values. If the statistical features of the calculator are used, it is important to show the function with the substitution of the relevant numbers. For example: in part of the solution it is acceptable to show $\text{normalcdf}(10, 40, 50, 20)$ or the equivalent syntax for the calculator used.

When using the calculator, you should provide a decimal answer that is correct to **at least two decimal places** (unless otherwise indicated). Such rounding should occur **only** in the final step of the solution.

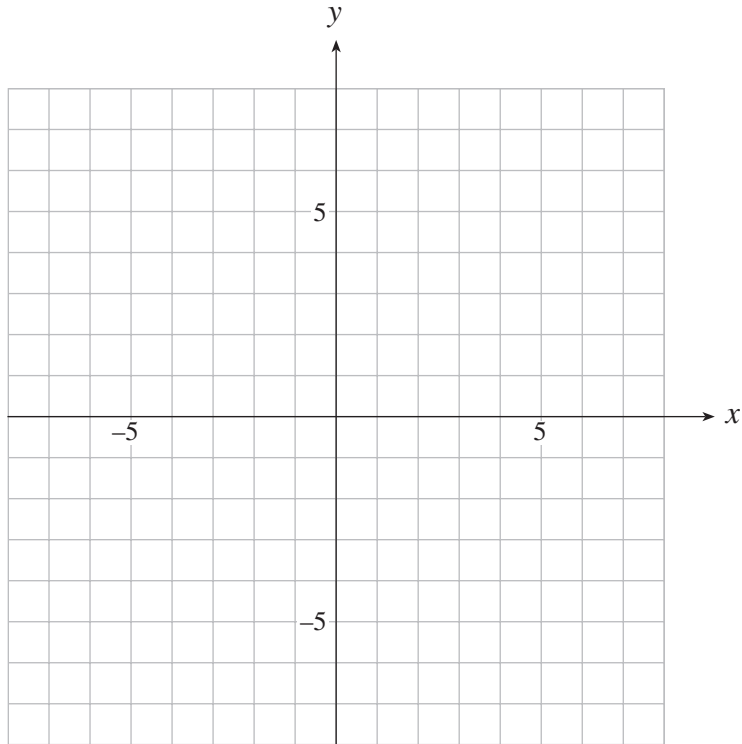
Full marks will NOT be given for the final answer only.

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



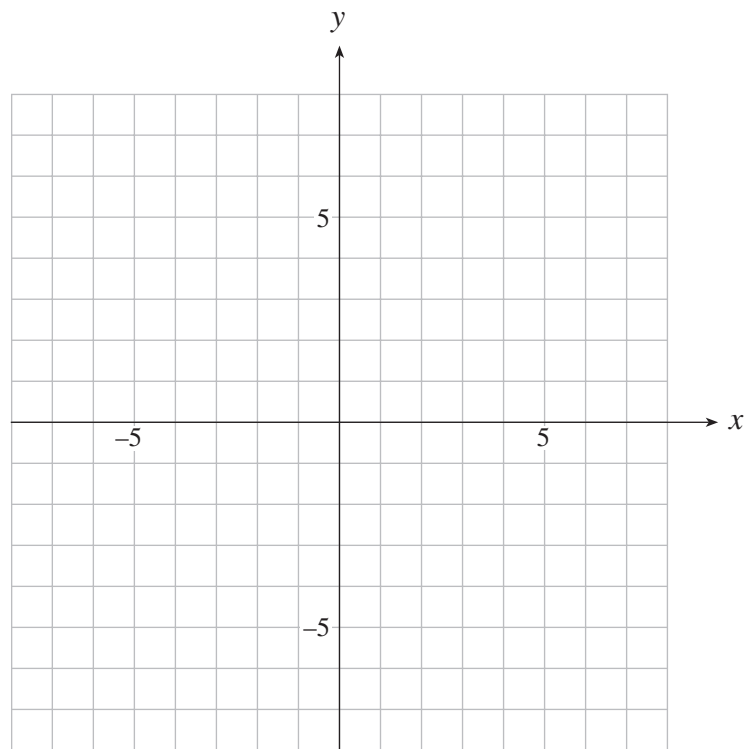
a) On the grid provided, sketch the graph of $y = f(-x) - 3$.

(2 marks)



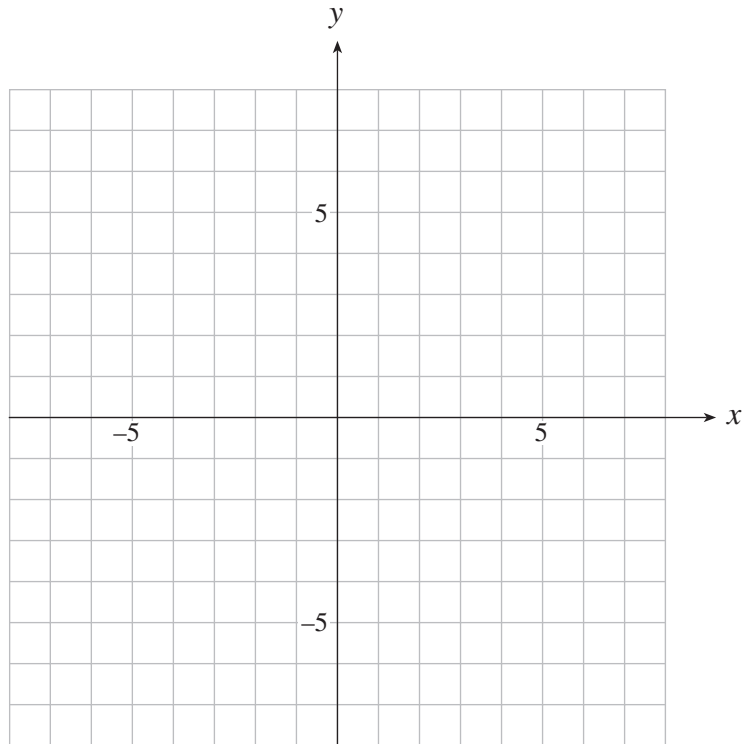
b) On the grid provided, sketch the graph of $y = \frac{1}{f(x)}$.

(3 marks)



2. Determine the equation in standard form of the parabola with vertex $(5, -2)$, passing through the point $(2, 0)$, and having a horizontal axis of symmetry. **(4 marks)**

Grid is provided for rough work only.



ANSWER:

3. The population of a nest of ants can multiply threefold (triple) in 8 weeks. If the population is now 12 000, how many weeks will it take for the population to reach 300 000 ants?
(Solve algebraically using logarithms. Answer accurate to at least 2 decimal places.) **(5 marks)**

ANSWER:

4. In the Canadian Junior Hockey League, 60% of the players are from Eastern Canada and 40% are from Western Canada. From this league, 18% of the Eastern players and 12% of the Western players go on to play in the NHL. If a randomly chosen NHL player who came from the Canadian Junior Hockey League is selected, what is the probability that he is from Western Canada? **(4 marks)**

ANSWER:

5. A multiple-choice test has 48 questions. Each question has four choices, only one of which is correct. If a student answers all the questions by randomly guessing, determine the probability that the student will correctly answer between 10 and 13 questions inclusive by using the following methods.

- a) Use the binomial distribution to obtain this probability.
(Answer accurate to at least 4 decimal places.)

(2 marks)

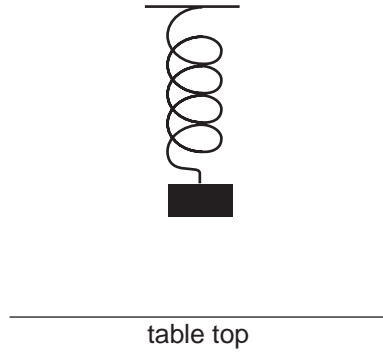
ANSWER:

- b) Use the normal approximation to the binomial distribution to obtain an estimate of this probability. (Answer accurate to at least 4 decimal places.) **(2 marks)**

ANSWER:

OVER

6. A mass is supported by a spring so that it rests 50 cm above a table top, as shown in the diagram below. The mass is pulled down to a height of 20 cm above the table top and released at time $t = 0$. It takes 0.8 seconds for the mass to reach a maximum height of 80 cm above the table top. As the mass moves up and down, its height h , in cm, above the table top, is approximated by a sinusoidal function of the elapsed time t , in seconds, for a short period of time.



Determine an equation for a sinusoidal function that gives h as a function of t . **(4 marks)**

ANSWER:

7. Prove the identity:

(4 marks)

$$\csc \theta \sin 2\theta - \sec \theta \cos 2\theta = \sec \theta$$

LEFT SIDE	RIGHT SIDE

END OF EXAMINATION

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A SUMMARY OF BASIC IDENTITIES AND FORMULAE

Pythagorean Identities:

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$1 + \tan^2 \theta = \sec^2 \theta$$

$$1 + \cot^2 \theta = \csc^2 \theta$$

Reciprocal and Quotient Identities:

$$\sec \theta = \frac{1}{\cos \theta}$$

$$\csc \theta = \frac{1}{\sin \theta}$$

$$\cot \theta = \frac{1}{\tan \theta}$$

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

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

Addition Identities:

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

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

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

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

Double-Angle Identities:

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

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

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

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

Formulae:

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

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

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

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

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

Probability and Statistics:

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

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

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

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

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

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

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

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

$$(q = 1 - p)$$

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

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

$$\mu = np$$

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

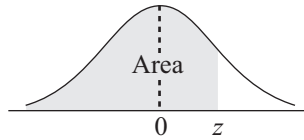
$$z = \frac{x - \mu}{\sigma}$$

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

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

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THE STANDARD NORMAL DISTRIBUTION TABLE



$$F_z(z) = P[Z < z]$$

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

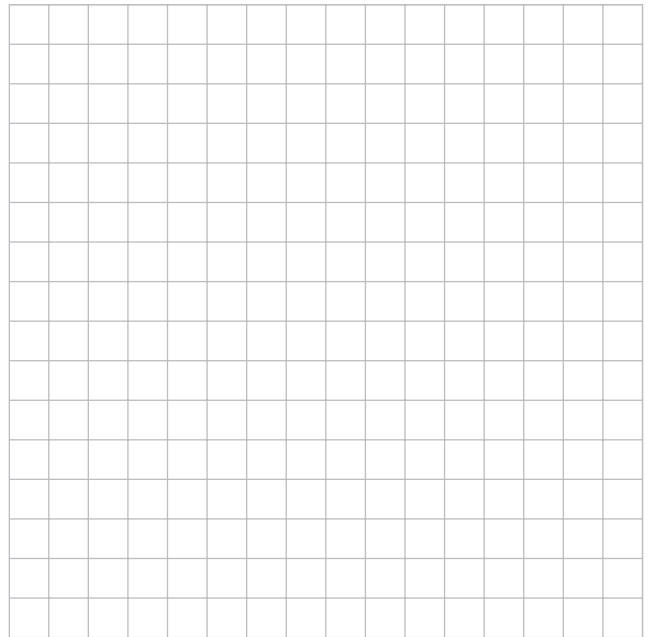
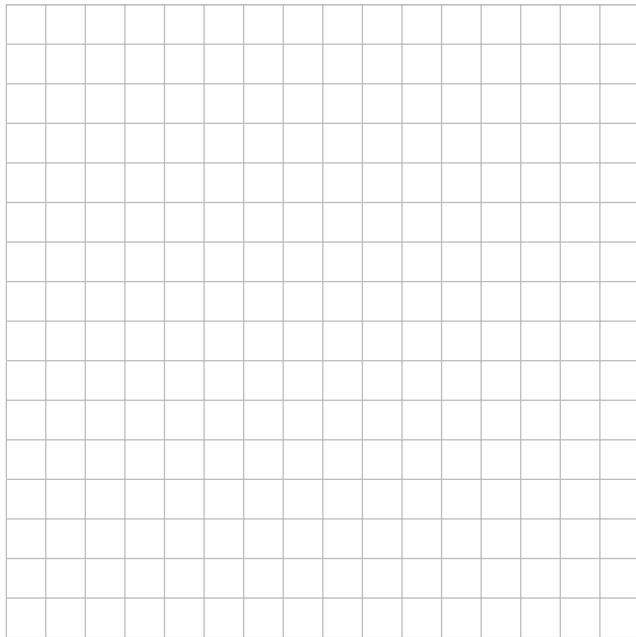
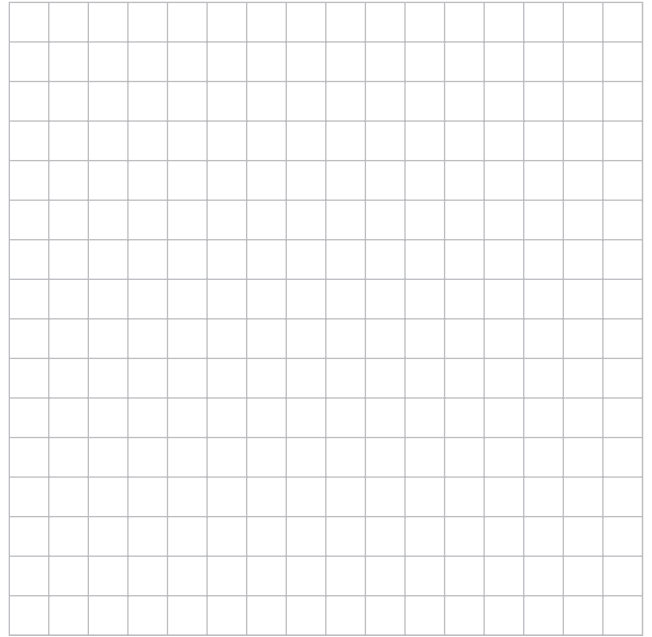
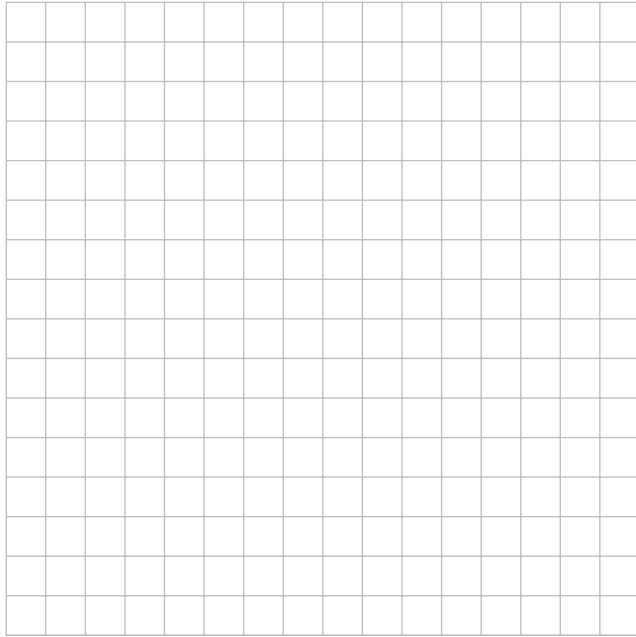
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$$F_z(z) = P[Z < z]$$

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

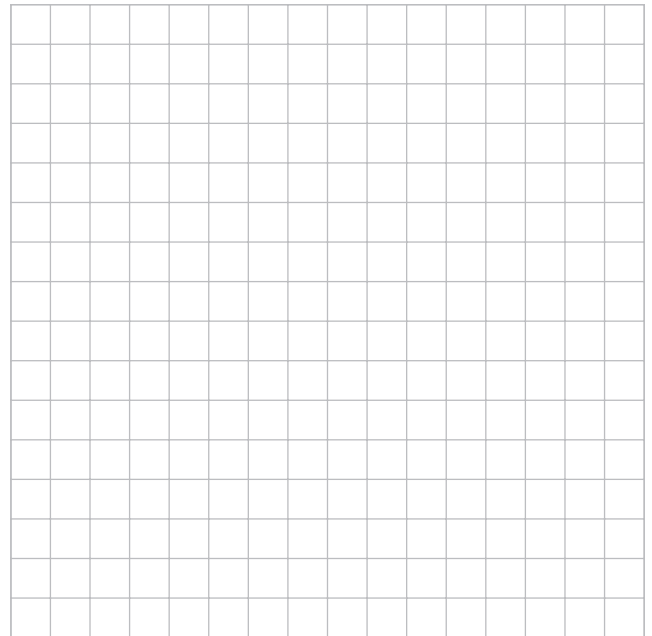
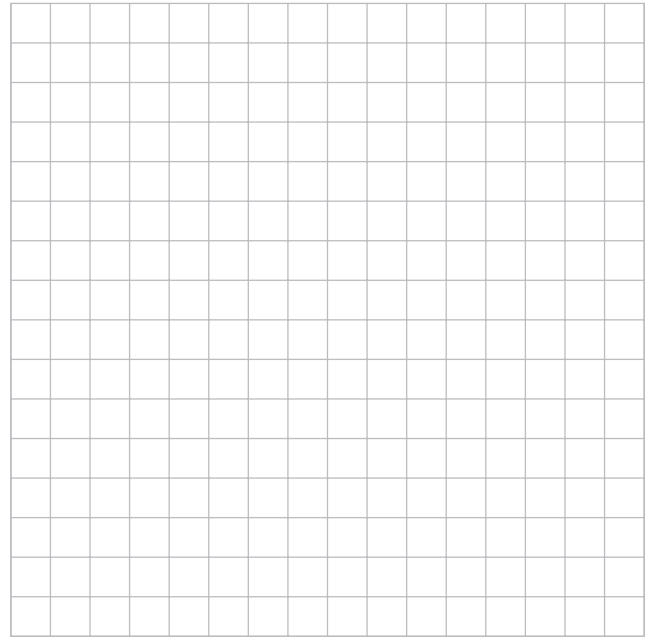
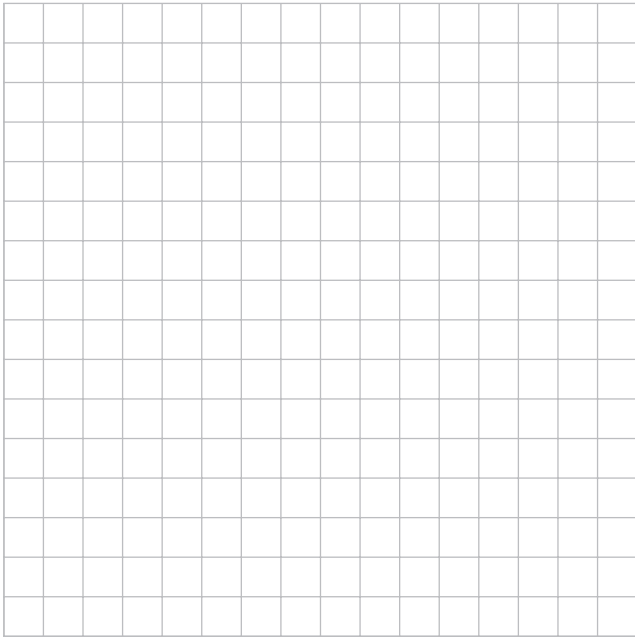
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