BRITISH COLUMBIA
The Best Place on Earth

Principles of Mathematics 12

Examination Booklet
Sample 2007/08

Form A

DO NOT OPEN ANY EXAMINATION MATERIALS UNTIL INSTRUCTED TO DO SO.

FOR FURTHER INSTRUCTIONS REFER TO THE RESPONSE BOOKLET.

Contents: 16 pages
44 multiple-choice questions in the Examination Booklet
8 written-response questions in the Response Booklet

Examination: 2 hours
Additional Time Permitted: 60 minutes

PART A: MULTIPLE CHOICE (non-calculator)
SECTION I

Suggested Time: 35 minutes
Value: 24 marks **Allowable Time: 45 minutes**

INSTRUCTIONS: **No calculator may be used for this section of the examination.** For each question, select the **best** answer and record your choice on the **blue Answer Sheet** provided. Using an HB pencil, completely fill in the bubble that has the letter corresponding to your answer.

You have **Examination Booklet Form A**. In the box above #1 on your **Answer Sheet**, fill in the bubble as follows.

Exam Booklet Form/ Cahier d'examen	A	B	C	D	E	F	G	H
	●	○	○	○	○	○	○	○

1. Evaluate: $\tan\frac{5\pi}{3}$

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

B. $\frac{1}{\sqrt{3}}$

C. $-\sqrt{3}$

D. $\sqrt{3}$

2. Determine the period of the function $y = 3\cos\frac{\pi}{4}x$.

A. $\frac{\pi}{4}$

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

C. 4

D. 8

3. The terminal arm of angle θ in standard position intersects the unit circle at the point $(m,\ n)$. Which expression represents $\cot\theta$?

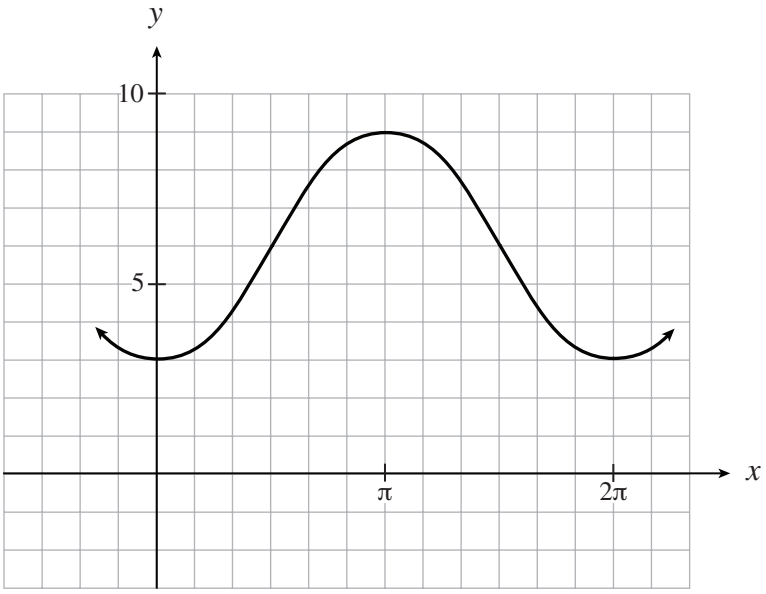
   A. m

   B. n

   C. $\frac{n}{m}$

   D. $\frac{m}{n}$

4. If the graph of the function shown below has the equation $y = a\cos b(x - c) + d$, determine the value of d.



   A. 3
   B. 5
   C. 6
   D. 9

5. Determine an equation of an asymptote of $y = \sec 3x$.

A. $x = \frac{\pi}{6}$

B. $x = \frac{\pi}{3}$

C. $x = \frac{2\pi}{3}$

D. $x = \pi$

6. Which expression is equivalent to $\sin(\pi + 2x)$?

A. $2\cos^2 x - 1$

B. $1 - 2\cos^2 x$

C. $2\sin x \cos x$

D. $-2\sin x \cos x$

7. Solve $\sqrt{3}\cos x \tan x + \cos x = 0$, where $0 \le x < 2\pi$.

A. $\frac{\pi}{6}, \frac{7\pi}{6}$

B. $\frac{5\pi}{6}, \frac{11\pi}{6}$

C. $\frac{\pi}{6}, \frac{7\pi}{6}, \frac{\pi}{2}, \frac{3\pi}{2}$

D. $\frac{5\pi}{6}, \frac{11\pi}{6}, \frac{\pi}{2}, \frac{3\pi}{2}$

8. Solve $\cos 2x - 3\sin x = 2$, where $-\pi \le x \le \pi$.

A. $\frac{7\pi}{6}, \frac{11\pi}{6}, \frac{3\pi}{2}$

B. $\frac{4\pi}{3}, \frac{5\pi}{3}, \frac{3\pi}{2}$

C. $-\frac{\pi}{6}, -\frac{5\pi}{6}, -\frac{\pi}{2}$

D. $-\frac{\pi}{3}, -\frac{2\pi}{3}, -\frac{\pi}{2}$

9. Determine the domain of $y = \log(x+1)$.

A. $x < 1$
B. $x > 1$
C. $x < -1$
D. $x > -1$

10. Determine an equivalent expression for $\log \frac{100a^2}{\sqrt{b}}$.

A. $2\log 100a - \frac{1}{2}\log b$

B. $2 + 2\log a - \frac{1}{2}\log b$

C. $4\log a - \frac{1}{2}\log b$

D. $100 + 2\log a - \frac{1}{2}\log b$

11. Evaluate: $\log_{\sqrt{7}} 7^3$

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

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

C. 6

D. 9

12. As an iceberg melts during the summer, it loses 3% of its mass every 5 days. This iceberg reduces to 40% of its original mass after t days. Which equation could be used to determine the value of t?

A. $40 = 100(0.97)^{\frac{t}{5}}$

B. $40 = 100(0.97)^{\frac{5}{t}}$

C. $40 = 100(1.03)^{\frac{t}{5}}$

D. $40 = 100(1.03)^{\frac{5}{t}}$

13. Solve: $\log_2\left(\log_9 x\right) = -1$

A. $\frac{1}{81}$

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

C. 3

D. 81

14. Solve: $5^{x+1} = 2\left(3^{2x}\right)$

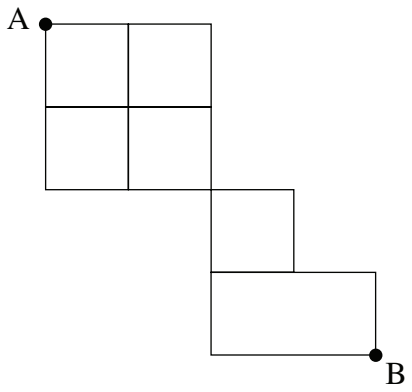
A. $x = \frac{-\log 5}{1 - 2\log 6}$

B. $x = \frac{-\log 5}{\log 5 - 2\log 6}$

C. $x = \frac{\log 2 - \log 5}{1 - 2\log 3}$

D. $x = \frac{\log 2 - \log 5}{\log 5 - 2\log 3}$

15. Determine the number of pathways from point A to point B if only moves to the right and down are permitted.



A. 18
B. 19
C. 23
D. 47

16. Which equation represents the graph of $y = f(x)$ after it is vertically compressed by a factor of $\frac{1}{2}$ and then translated 2 units to the left?

A. $\frac{y}{2} = f(x+2)$

B. $\frac{y}{2} = f(x-2)$

C. $2y = f(x+2)$

D. $2y = f(x-2)$

This is the end of Part A, Section I.

You may proceed to the rest of the examination *without* the use of a calculator until directed by the supervisor to access your calculator. At the end of 45 minutes, you will not be able to go back to Part A, Section I; therefore, ensure you have checked this section.

PART A: MULTIPLE CHOICE
SECTION II

Value: 42 marks **Suggested Time: 55 minutes**

INSTRUCTIONS: For each question, select the **best** answer and record your choice on the **white Answer Sheet** provided. Using an HB pencil, completely fill in the bubble that has the letter corresponding to your answer.

17. Determine the inverse of the function $f(x) = \frac{4x+1}{3x}$.

A. $f^{-1}(x) = \frac{1}{3x-4}$

B. $f^{-1}(x) = \frac{-1}{3x-4}$

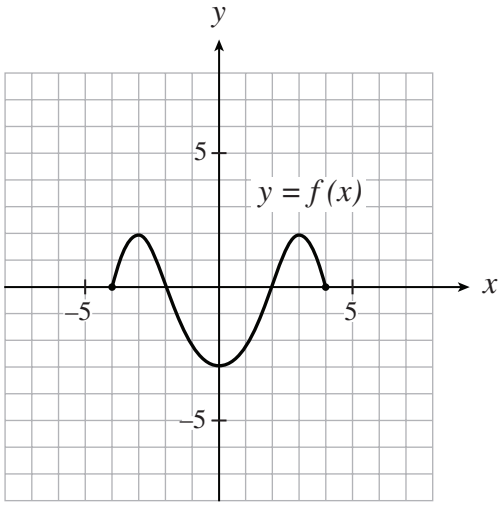
C. $f^{-1}(x) = \frac{3x}{4x+1}$

D. $f^{-1}(x) = \frac{-3x}{4x+1}$

18. The *y*-intercept of the function $y = f(x)$ is 5. Determine the *y*-intercept of $y = -f(x) + 3$.

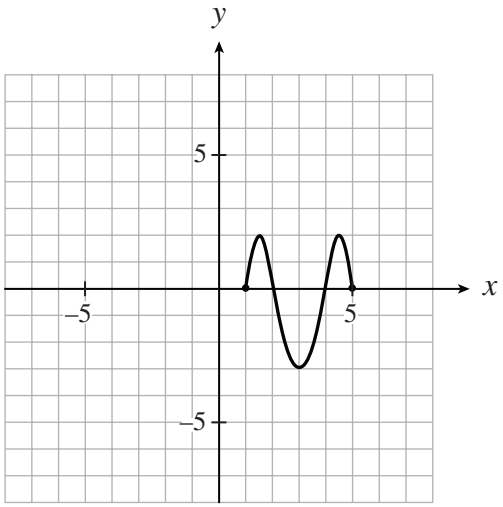
A. -2
B. -8
C. 8
D. 2

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



Which of the following is the graph of $y = f(2x) - 3$?

A.



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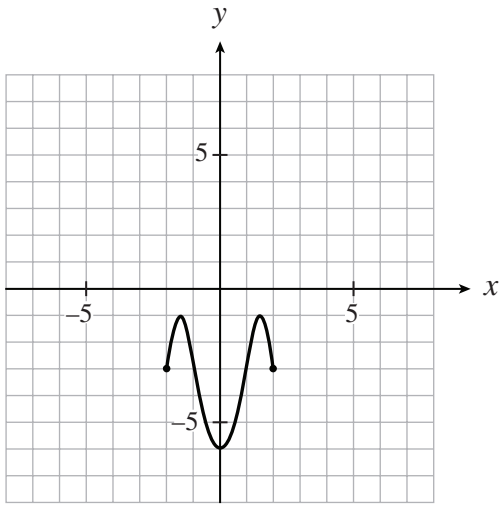
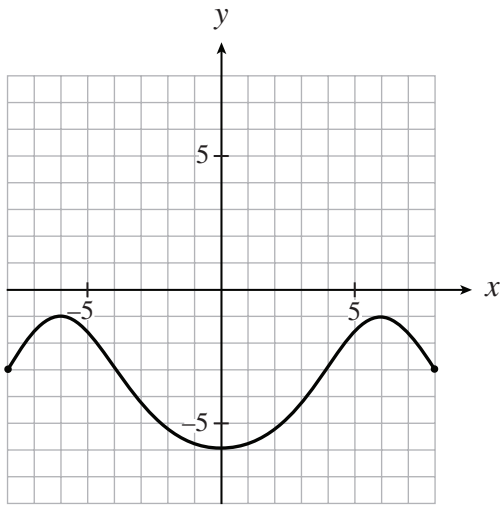
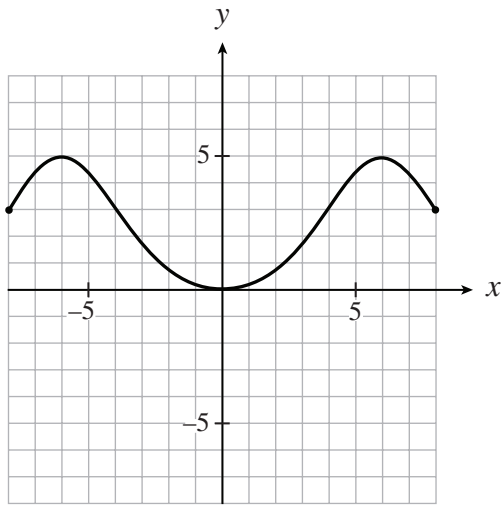


C.



D.



20. If the point $(10,\ 6)$ is on the graph of $y = f(x)$, what point must be on the graph of $y = f(-2x - 4)$?

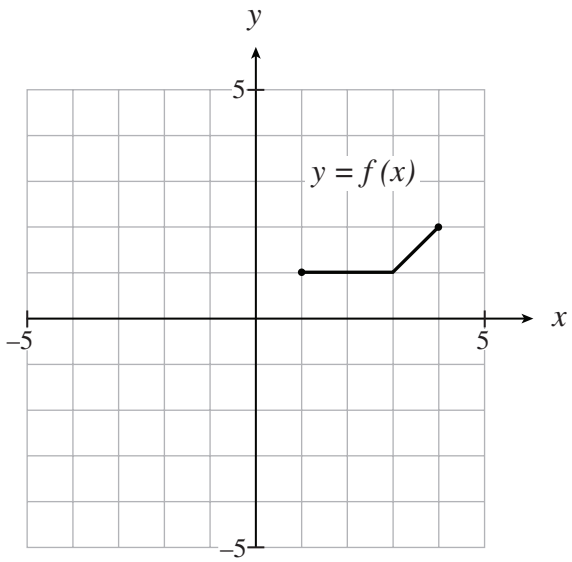
A. $(-7,\ 6)$

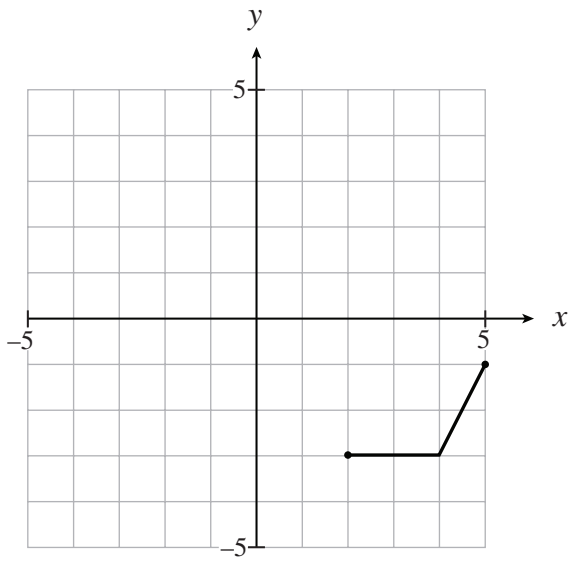
B. $(-9,\ 6)$

C. $(-22,\ 6)$

D. $(-24,\ 6)$

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





A. $y = \frac{1}{2} f(x - 1) - 5$

B. $y = \frac{1}{2} f(x - 1) - 4$

C. $y = 2f(x - 1) - 5$

D. $y = 2f(x - 1) - 4$

22. Solve $2\cos x = 2^x$, where $-\pi \le x \le \pi$.

A. $-1.45,\ 0.57$
B. $-1.38,\ 0.66$
C. $-1.38,\ 0,\ 0.66$
D. $-1.11,\ 1.72,\ 2.93$

23. The height above the ground, *h* metres, of a person on a Ferris wheel at time *t* seconds, is given by the formula $h(t) = -20\cos\frac{2\pi}{40}t + 23$, where $t \ge 0$. Determine the earliest time at which the person will be 15 m above the ground.

A. 7.38 s
B. 12.62 s
C. 32.62 s
D. 37.14 s

24. A circle has a radius of 18 cm. If the length of arc AB is 21π cm, as shown in the diagram, determine the measure of the central angle θ in degrees.

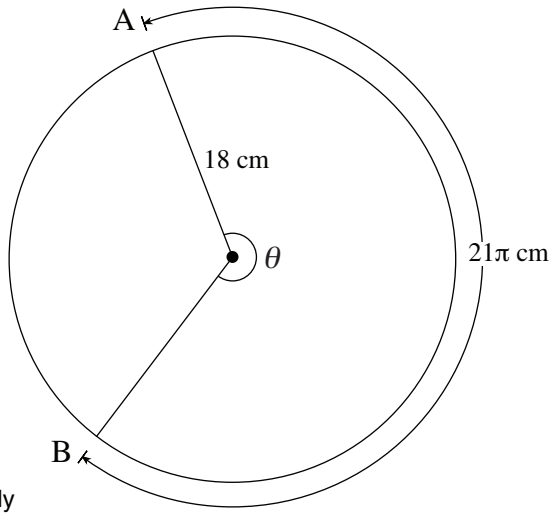


Diagram not necessarily drawn to scale.

A. 120°
B. 150°
C. 210°
D. 240°

25. Determine the restrictions for $\frac{3+2\csc\theta}{2\sec\theta-3}$.

A. $\sin\theta \neq 0,\ \cos\theta \neq 0$

B. $\cos\theta \neq \frac{2}{3},\ \cos\theta \neq 0$

C. $\cos\theta \neq \frac{2}{3},\ \sin\theta \neq 0,\ \cos\theta \neq 0$

D. $\sin\theta \neq -\frac{2}{3},\ \cos\theta \neq \frac{2}{3},\ \sin\theta \neq 0,\ \cos\theta \neq 0$

26. Determine the common ratio of the geometric sequence $\frac{a^2}{b^3},\ \frac{a}{b},\ b$.

A. $\frac{a}{b}$

B. $\frac{b}{a}$

C. $\frac{a}{b^2}$

D. $\frac{b^2}{a}$

Use the following information to answer questions 27 and 28.

Sam gave his nephew, Norman, \$1 on his 1st birthday, \$2 on his 2nd birthday, \$4 on his 3rd birthday, and so on. That is, on each subsequent birthday, Sam gave Norman double the previous year's amount.

27. How much money did Sam give Norman on his 15th birthday?

A. \$16 383
B. \$16 384
C. \$32 767
D. \$32 768

28. In total, how much money did Sam give Norman up to and including his 21st birthday?

A. \$1 048 575
B. \$1 048 576
C. \$2 097 151
D. \$2 097 152

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29. Evaluate: $\sum_{k=2}^{\infty} (-0.3)^k$

A. -0.23
B. 0.07
C. 0.13
D. 0.77

30. In a geometric sequence, $t_4 = 108$ and $t_6 = 243$. Determine a possible first term.

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

B. $\frac{64}{3}$

C. 32

D. 48

31. If $x-2,\ x+4,\ 5x+2$ are three consecutive terms in a geometric sequence, determine the numerical value(s) of the common ratio(s).

A. -1
B. $-4,\ -1$
C. $-3,\ 3$
D. $3,\ -1$

32. Change to logarithmic form $a^3 = b$.

A. $3 = \log_a b$
B. $3 = \log_b a$
C. $b = \log_a 3$
D. $a = \log_b 3$

33. A population grows continuously according to the formula $P = P_0 e^{kt}$, where P is the final population at the end of t years, P_0 is the initial population and k is the annual growth rate. What will the population be at the end of 8 years if the initial population is 15 million and the annual growth rate is 4%?

A. 20.66 million
B. 124.90 million
C. 179.02 million
D. 367.99 million

34. Determine the magnitude of an earthquake that is half as intense as an earthquake of magnitude 8.0 on the Richter scale.

A. 4.0
B. 5.0
C. 7.7
D. 8.3

35. A license plate consists of 3 letters followed by 3 digits. The letters I, O, Q, U, Y and Z are not used. If repetitions of letters and digits are allowed, determine the total number of possible license plates (e.g. ABB603).

A. 4 924 800
B. 5 832 000
C. 8 000 000
D. 17 576 000

36. Determine the number of different arrangements of all the letters in the word APPLESEED.

A. 30 240
B. 60 480
C. 181 440
D. 362 880

37. In a standard deck of 52 cards, how many different 5-card hands are there that contain at most 2 face cards?

A. 652 080
B. 844 272
C. 1 748 760
D. 2 406 768

38. In the expansion of $\left(a^2 - b\right)^4$, determine the middle term.

A. a^2b^2
B. $6a^2b^2$
C. a^4b^2
D. $6a^4b^2$

39. In how many different ways can a family of 5 people (2 parents and 3 children) sit in a row if a parent must sit on each end of the row?

A 6
B. 12
C. 24
D. 120

40. Consider the following 2 events:

Event A: A fair coin is tossed and shows tails.
Event B: A fair 6-sided die is rolled and shows a number greater than 2.

Determine $P(A \text{ and } B)$.

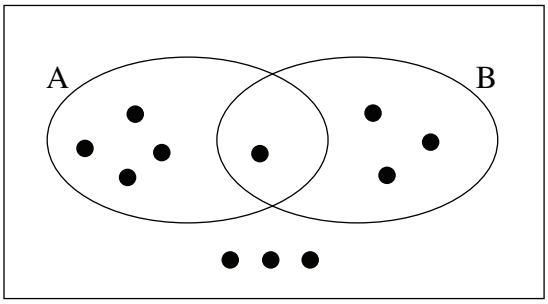
A. $\frac{1}{3}$

B. $\frac{1}{6}$

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

D. $\frac{2}{3}$

41. The diagram below represents a sample space of 11 equally likely outcomes.
Determine $P(\overline{A})$.



A. $\frac{4}{11}$

B. $\frac{5}{11}$

C. $\frac{6}{11}$

D. $\frac{7}{11}$

42. Two hockey players, Tom and Jerry, each shoot a penalty shot at a goal.
Tom has a $\frac{1}{2}$ chance of scoring the goal and Jerry has a $\frac{2}{5}$ chance of scoring the goal.
Assuming independence, what is the probability that at least one of them will score the goal?

A. $\frac{7}{10}$

B. $\frac{5}{10}$

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

D. $\frac{2}{10}$

43. A 3-card hand is dealt from a standard deck of 52 cards. What is the probability that the hand will contain exactly one queen?

A. 0.0510
B. 0.2042
C. 0.2308
D. 0.4512

44. A fair coin is tossed 30 times. What is the probability that the coin will show heads fewer than 17 times?

A. 0.1115
B. 0.2923
C. 0.7077
D. 0.8192

You have **Examination Booklet Form A**. In the box above #1 on your **Answer Sheet**, ensure you filled in the bubble as follows.

Exam Booklet Form/ Cahier d'examen	A	B	C	D	E	F	G	H
	●	○	○	○	○	○	○	○

This is the end of the multiple-choice section.
Answer the remaining questions directly in the Response Booklet

A Summary of Basic Identities and Formulae

Pythagorean Identities:

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

Reciprocal and Quotient Identities:

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

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

Addition Identities:

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

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

Double-Angle Identities:

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

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

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

Formulae:

$$t_n=ar^{n-1} \qquad S_n=\frac{a\left(1-r^n\right)}{1-r} \qquad S_n=\frac{a-r\ell}{1-r} \qquad S=\frac{a}{1-r} \qquad x=\frac{-b\pm\sqrt{b^2-4ac}}{2a}$$

Combinatorics and Probability:

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

$$P\left(\overline{A}\right)=1-P(A) \qquad P(A \text{ or } B)=P(A)+P(B)-P(A \text{ and } B)$$

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

$$P(x)={}_nC_x\,p^xq^{n-x} \qquad q=1-p$$

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

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ROUGH WORK FOR GRAPHING

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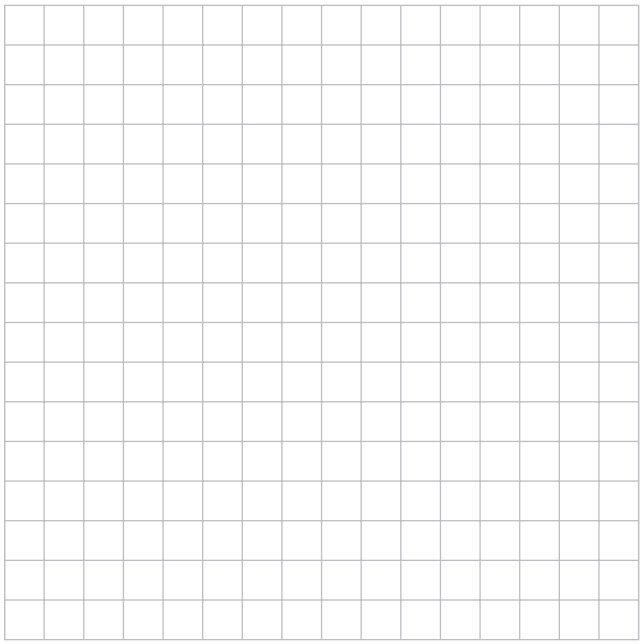

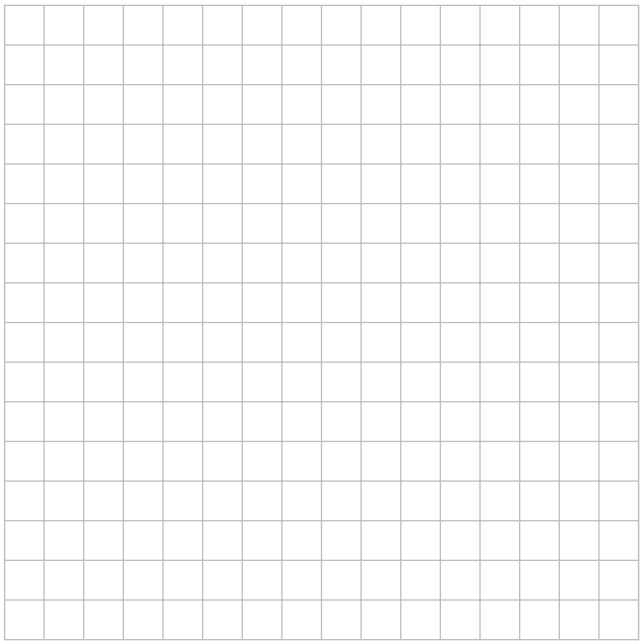

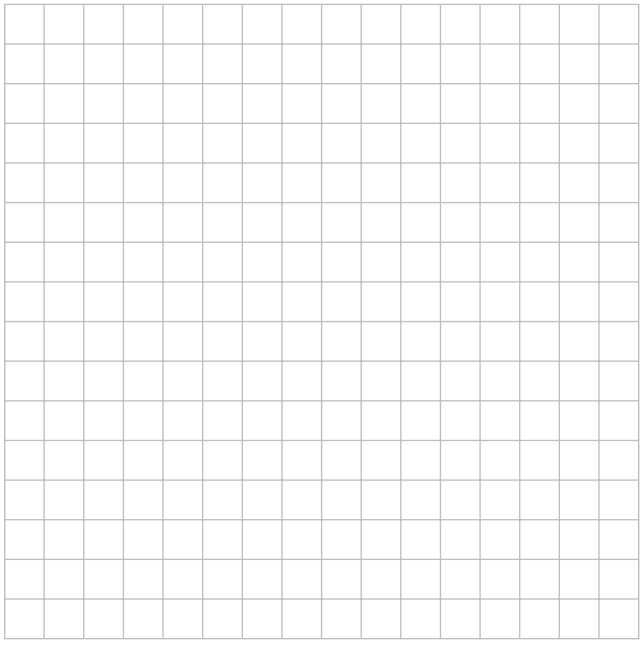

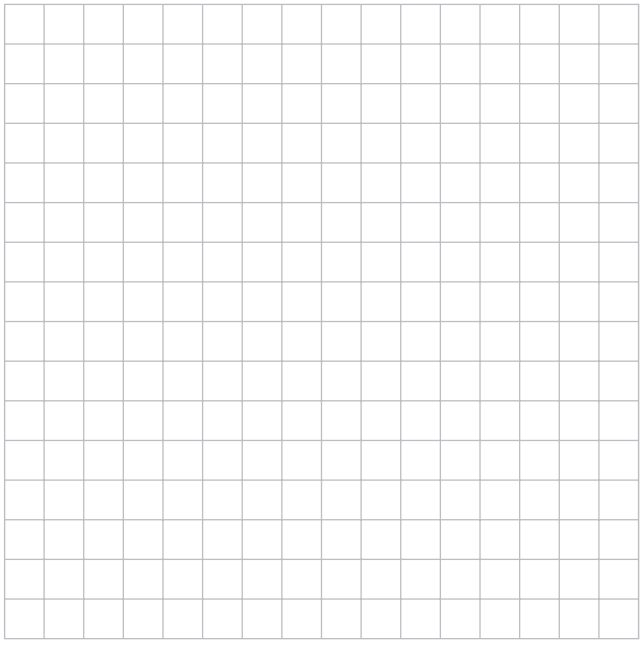

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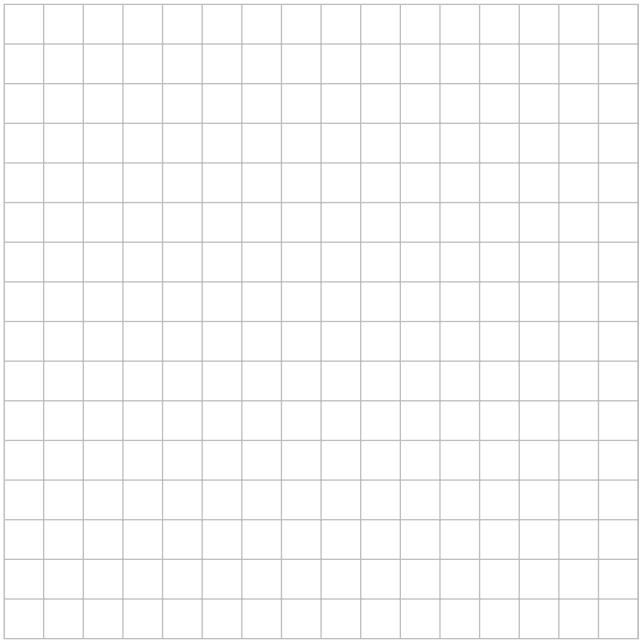

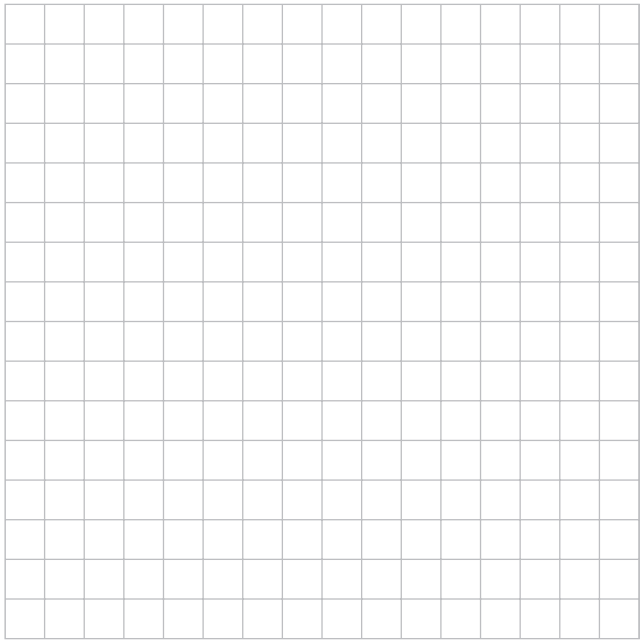

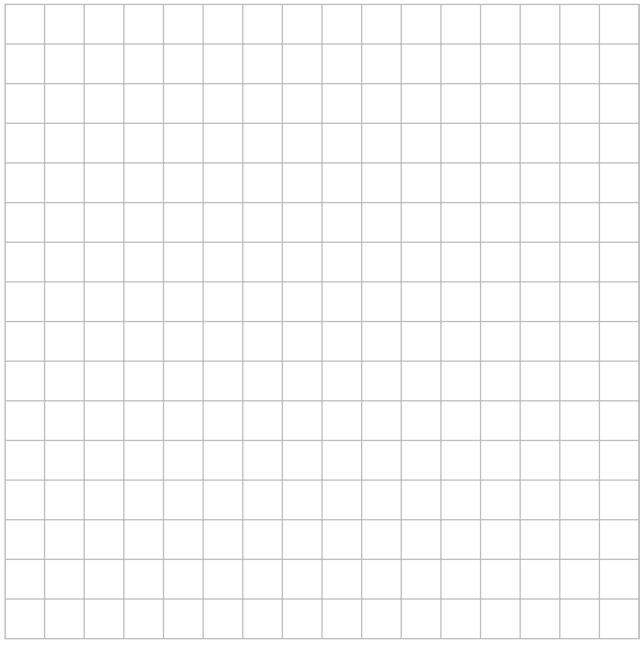

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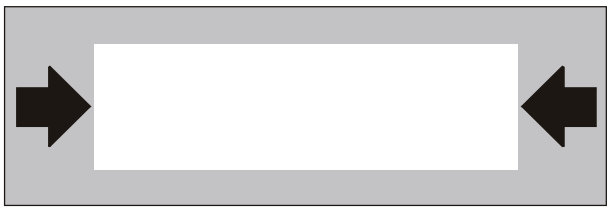

Course Code = MA 12

SAMPLE 2007/08

Exam Booklet Form/ Cahier d'examen A B C D E F G H

Student Instructions

1. Place your Personal Education Number (PEN) label at the top of this Booklet. On each of your Answer Sheets (one blue bubble sheet and one white bubble sheet) fill in the bubble (Form A, B, C, D, E, F, G or H) that corresponds to the letter on your Examination Booklet.
2. Use a pencil to fill in bubbles when answering questions on your Answer Sheet.
3. When answering questions in Section I (45 minutes):
   - use the blue answer sheet.
   - calculators are not permitted.
   - you may proceed to other questions that do not require the use of a calculator if you finish this section early. Note: no calculator will be allowed for the first 45 minutes of the examination.
   - you will NOT be able to return to this section after the time limit.
4. When using a calculator:
   - round final answers with decimals to at least two decimal places unless otherwise indicated in the question.
5. Read the Examination Rules on the back of this Booklet.

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Question 1							
0	1	2	3			(.5)	NR
☐	☐	☐	☐			☐	☐
Question 2							
0	1	2				(.5)	NR
☐	☐	☐				☐	☐
Question 3							
0	1	2	3	4	5	(.5)	NR
☐	☐	☐	☐	☐	☐	☐	☐
Question 4							
0	1	2	3			(.5)	NR
☐	☐	☐	☐			☐	☐
Question 5							
0	1	2				(.5)	NR
☐	☐	☐				☐	☐
Question 6							
0	1	2	3			(.5)	NR
☐	☐	☐	☐			☐	☐
Question 7							
0	1					(.5)	NR
☐	☐					☐	☐
Question 8							
0	1	2	3	4	5	(.5)	NR
☐	☐	☐	☐	☐	☐	☐	☐

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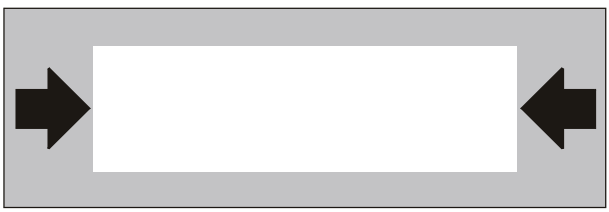

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Principles of Mathematics 12

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Response Booklet

BRITISH COLUMBIA
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PART B: WRITTEN RESPONSE

Value: 24 marks **Suggested Time: 30 minutes**

INSTRUCTIONS: Answer the following questions in the space provided in the **Response Booklet**.

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.

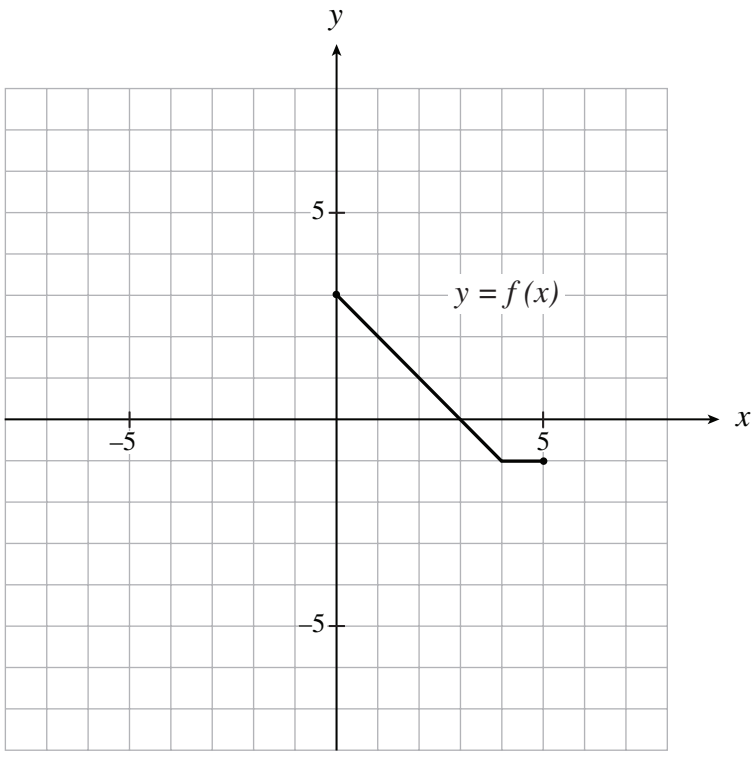
If, in a justification, a student refers to information generated by a graphing calculator, this information must be presented clearly in the response. If the statistical features of the calculator are used, it is important to show the function with the substitution of the relevant numbers. For example: in part of the solution it is acceptable to show binomcdf (20, 0.5, 10) or the equivalent syntax for the calculator used.

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

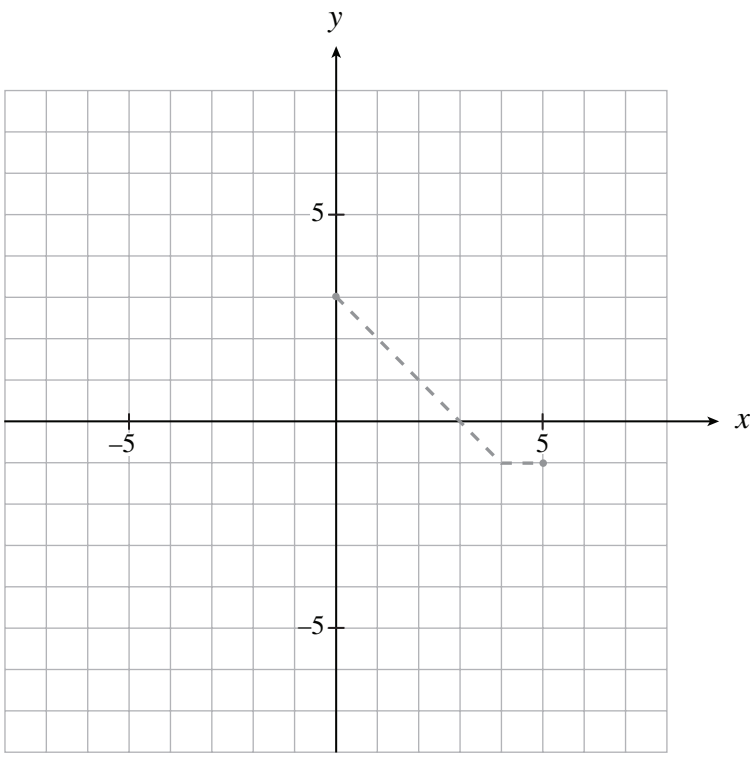
Full marks will NOT be given for a final answer only.

Use the following graph to answer questions 1 and 2.

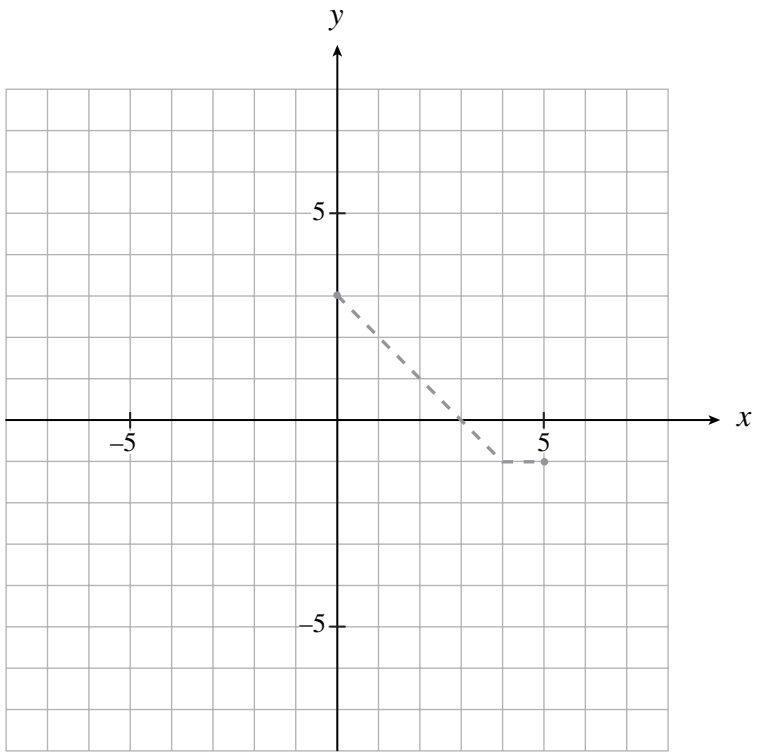
The graph of $y = f(x)$ is shown below.



1. On the grid provided, sketch the graph of $y = 2\left|\, f(x) - 1 \,\right|$. **(3 marks)**



2. On the grid provided, sketch the graph of $y = \dfrac{1}{f(x)}$. **(2 marks)**



3. Solve algebraically $\log 2 - \log(x-1) = \log(x+1) - \log(x+17)$. **(5 marks)**

Use the following information to answer questions 4 and 5.

It is known that 2% of the population has a certain disease. A test for this disease is 90% accurate. This means that the outcome of the test is correct 90% of the time. A positive test result claims that a person has the disease.

4. Determine the probability that a randomly selected person will test positive for this disease.
   (Answer accurate to at least 3 decimal places.) **(3 marks)**

5. Given that a randomly selected person tests positive, what is the probability that this person actually has the disease?

   (Answer accurate to at least 2 decimal places.) **(2 marks)**

6. A minimum value of a sinusoidal function is at $\left(\frac{\pi}{4},\ 3\right)$. The nearest maximum value to the right of this point is at $\left(\frac{7\pi}{12},\ 7\right)$. Determine an equation of this function. **(3 marks)**

7. The two smallest positive solutions of $\cos 4x = 0.6$ are $x = 0.23$ and $x = 1.34$.
   Determine the general solution for $\cos 4x = 0.6$. **(1 mark)**

8. Prove the identity: **(5 marks)**

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

LEFT SIDE	RIGHT SIDE

END OF EXAMINATION

Examination Rules

1. The time allotted for this examination is two hours.
   You may, however, take up to 60 minutes of additional time to finish.
2. Answers entered in the Examination Booklet will not be marked.
3. Cheating on an examination will result in a mark of zero. The Ministry of Education considers cheating to have occurred if students break any of the following rules:

   - Students must not be in possession of or have used any secure examination materials prior to the examination session.
   - Students must not communicate with other students during the examination.
   - Students must not give or receive assistance of any kind in answering an examination question during an examination, including allowing one's paper to be viewed by others or copying answers from another student's paper.
   - Students must not possess any book, paper or item that might assist in writing an examination, including a dictionary or piece of electronic equipment, that is not specifically authorized for the examination by ministry policy.
   - Students must not copy, plagiarize or present as one's own, work done by any other person.
   - Students must immediately follow the invigilator's order to stop writing at the end of the examination time and must not alter an Examination Booklet, Response Booklet or Answer Sheet after the invigilator has asked students to hand in examination papers.
   - Students must not remove any piece of the examination materials from the examination room, including work pages.

4. The use of inappropriate language or content may result in a mark of zero being awarded.
5. Upon completion of the examination, return all examination materials to the supervising invigilator.