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Grade 12  
Pre-Calculus Mathematics  
Standards Test

# Booklet 2

June 2011

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# Multiple-Choice Questions

## Instructions

- There are 15 multiple-choice questions.
- Each question is worth 1 mark.
- Read each question carefully.
- Examine all the choices before you decide on your answer.
- You may use the spaces beside each question for rough work.
- Record your answers on the sheet provided.
- Provide only one answer per question.
- There is no penalty for guessing.
- Answer all questions.
- Calculators (scientific or graphing) are **not** allowed for this part of the test.

No marks will be awarded for work done on this page.

## Multiple-Choice Questions

12. The quadrant where  $\sec \theta < 0$  and  $\cot \theta > 0$  is:

- a) I
- b) II
- c) III
- d) IV

13. The length of the minor axis for the equation  $\frac{(x-3)^2}{16} + \frac{(y+1)^2}{9} = 1$  is:

- a) 3
- b) 4
- c) 6
- d) 8

14. If  $e^{3x} = 27$  then an expression for the value of  $x$  is:

- a) 3
- b)  $\frac{\ln 27}{3}$
- c) 1
- d)  $\frac{\log 27}{3}$

15. Evaluate:

$$\frac{{}_9P_4}{{}_9P_5}$$

- a) 5
- b) 1
- c)  $\frac{4}{5}$
- d)  $\frac{1}{5}$

16. What is the  $y$ -intercept of  $y = \cos x$ ?

- a) 0
- b) 1
- c)  $\frac{\pi}{2}$
- d)  $\pi$

17. If  $A = \cos \frac{\pi}{2}$ ,  $B = \cos \pi$ , and  $C = \cos 2\pi$  then:

- a)  $A < B < C$
- b)  $B < A < C$
- c)  $C < B < A$
- d)  $B < C < A$

18. Which one of the following equations represents the same graph as  $y = -\sin x$ ?

a)  $y = \cos(-x)$

b)  $y = -\cos x$

c)  $y = \cos\left(x - \frac{\pi}{2}\right)$

d)  $y = \cos\left(x + \frac{\pi}{2}\right)$

19. Determine the value of  $a$  if  $\log_{16} a = \frac{1}{2}$ .

a) 4

b) 8

c) 32

d) 256

20. The probability that Sophie goes to a restaurant is  $\frac{1}{4}$ .

When she goes to a restaurant, the probability that she orders pasta is  $\frac{1}{3}$ .

What is the probability that Sophie goes to a restaurant but does not order pasta?

a)  $\frac{1}{12}$

b)  $\frac{2}{12}$

c)  $\frac{7}{12}$

d)  $\frac{11}{12}$

21. How many ways can four married couples be seated in a row of 8 chairs if each person wants to sit with their partner?

a)  $4! \cdot 2^4$

b)  $4! \cdot 2^3$

c)  $4! \cdot 2^2$

d)  $4! \cdot 2$

22. How many 5-letter arrangements are possible using the letters P, P, P, O, Y?

a)  $3!$

b)  $5!$

c)  $\frac{5!}{3!}$

d)  $\frac{5!}{3!2!}$

23. The number of ways to arrange 3 boys and 3 girls in a circle if the boys and girls alternate is:

a)  $5! \cdot 2$

b)  $5!$

c)  $3! \cdot 3!$

d)  $3! \cdot 2!$

24. A and B are mutually exclusive events.  
The probability of event A is 0.6 and the probability of event B is 0.3.  
What is the value of  $P(A \text{ or } B)$ ?
- a) 0.9
  - b) 0.72
  - c) 0.3
  - d) 0.18
25. The conic section described by the equation  $(x + 2) = -3(y + 1)^2$  opens:
- a) down
  - b) up
  - c) left
  - d) right
26. An ellipse has a centre at  $(4, -6)$ , a vertex at  $(4, 0)$ , and a domain of  $[1, 7]$ .  
The equation for this ellipse is:
- a)  $\frac{(x - 4)^2}{9} + \frac{(y + 6)^2}{36} = 1$
  - b)  $\frac{(x + 4)^2}{9} + \frac{(y - 6)^2}{36} = 1$
  - c)  $\frac{(x - 4)^2}{3} + \frac{(y + 6)^2}{6} = 1$
  - d)  $\frac{(x + 4)^2}{3} + \frac{(y - 6)^2}{6} = 1$

No marks will be awarded for work done on this page.

# Short-Answer Questions

## Instructions

- There are 15 short-answer questions.
- Each question is worth 1 mark.
- Calculators are **not** allowed for this part of the test.
- Write your final answer in the space provided.
- Work need not be shown in order to obtain full marks for a correct answer. However, in the case of an incorrect final answer, part marks may be awarded only if work is shown.
- Solutions need not have rationalized denominators.

No marks will be awarded for work done on this page.

## Short-Answer Questions

Do Not  
Use

(1 mark) 27. Identify the conic section whose equation is  $3x^2 - 3y^2 + 12x - 6y = 0$ .

119

(1 mark) 28. The point  $(-4, 8)$  is on the graph of  $y = f(x)$ .

120

What point must be on the graph of  $y = f^{-1}(x)$ ?

(1 mark) 29.  $P(\theta)$  is on the unit circle with coordinates  $\left(\frac{5}{13}, -\frac{12}{13}\right)$ . Find the coordinates of  $P(\theta - \pi)$ .

121

(1 mark) 30. Given  $\log_b 3 = 0.2$ , determine the value of  $\log_b 81$ .

122

(1 mark) 31. Give the sample space for flipping a coin and selecting one marble from a box that contains one red marble, one green marble, and one blue marble.

123

(1 mark) 32. In the geometric sequence  $3x^7, m, 12x^3$ , determine an expression for  $m$ .

124

(1 mark) 33. Determine the exact value of:

$$\frac{\tan 70^\circ - \tan 10^\circ}{1 + \tan 70^\circ \tan 10^\circ}$$

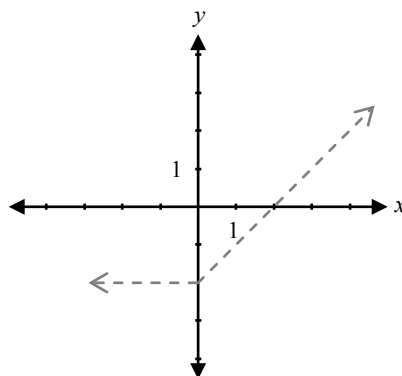
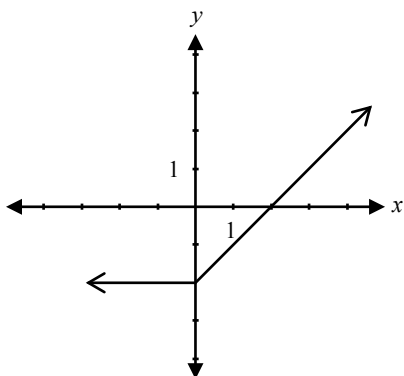
125

(1 mark) 34. Determine which simplified term contains  $x^{25}$  in the expansion of the following binomial.

$$(x^5 - 1)^7$$

126

(1 mark) 35. Given the graph of  $y = f(x)$  below, sketch the graph of  $y = |f(x)|$ .



The graph of  $y = f(x)$  has already been drawn for your reference.  
No marks will be awarded for this graph.

127

(1 mark) 36. State the domain for the graph of the following function:

$$y = \log_2(x + 3)$$

128

(1 mark) 37. Find the exact value of  $\sin\left(\frac{11\pi}{3}\right)$ .

129

(1 mark) 38. If  $\theta = 4$ , in which quadrant is  $P(\theta)$ ?

130

(1 mark) 39. Write the equation of a circle with a radius of 6 that has a centre of  $(-1, 4)$ .

131

(1 mark) 40. Solve:

$$3^{2x-1} = 27^x$$

132

(1 mark) 41. Express as a single logarithm:

$$\log A - 2\log B$$

133

No marks will be awarded for work done on this page.

# Long-Answer Questions

## Instructions

- There are 12 long-answer questions worth a total of 34 marks.
- Calculators are **not** allowed for this part of the test.
- Write each solution in the space provided.
- For full marks, your answers must show all pertinent diagrams, calculations, and explanations.
- Your solutions should be neat, clear and well organized.
- If any curve contains asymptotes, the asymptotes should be included in the graph.
- Solutions need not have rationalized denominators.

No marks will be awarded for work done on this page.

## Long-Answer Questions

Do Not  
Use

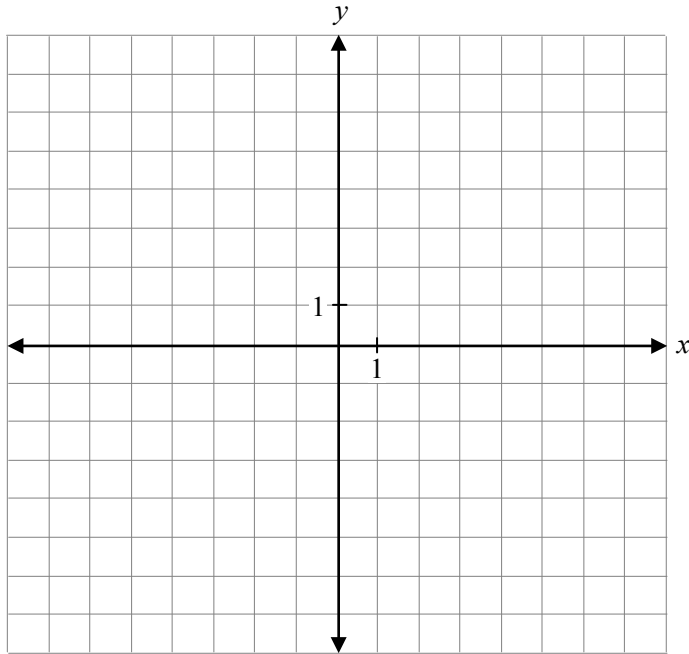
(3 marks) 42. Solve the following equation over the interval  $[0, 2\pi]$ .

$$\sec^2 \theta - \sec \theta - 2 = 0$$

134

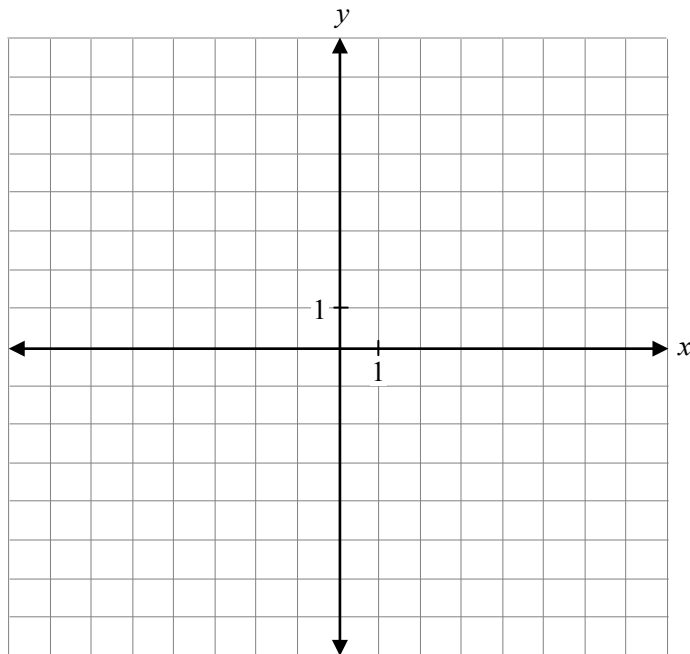
43. Sketch a clearly labelled graph of:

(1 mark) a)  $y = 3^x$



135

(2 marks) b)  $y = 2(3^x) + 1$



136

(3 marks) 44. Prove the following identity:

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

137

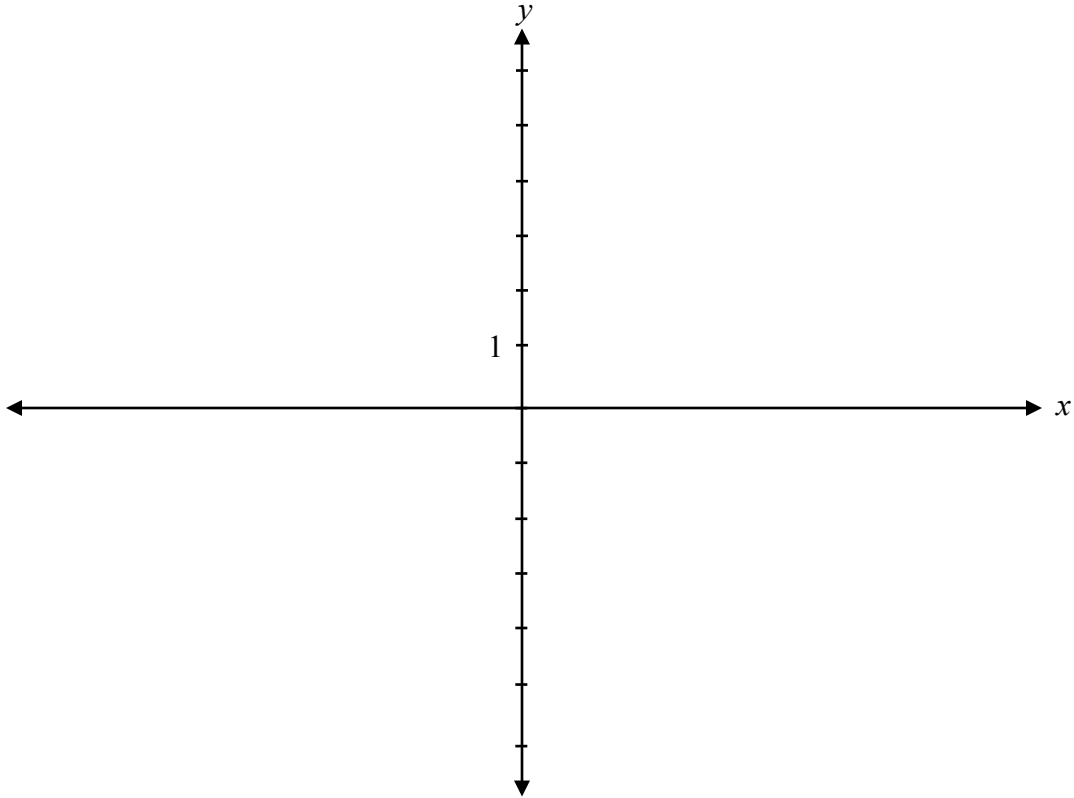
Left-hand side

Right-hand side

(3 marks) 45. Determine the exact value of  $\sin\left(\frac{19\pi}{12}\right)$ .

(4 marks) 46. Sketch a clearly labelled graph of at least one period of the following function:

$$y = 3 \cos \left[ 2 \left( x - \frac{\pi}{8} \right) \right] + 1$$



- (3 marks) 47. A certain population was studied over a period of time. It was determined that this population varied sinusoidally as a function of time.

At the start of year 4, the population reached its maximum of 27 000. The population gradually declined and, at the start of year 10, it reached its minimum of 13 000.

This situation can be modelled by the equation  $y = A \sin[B(x - C)] + D$ .

Determine the values of A, B, C, and D, where  $y$  represents the population and  $x$  represents time in years.

A = \_\_\_\_\_

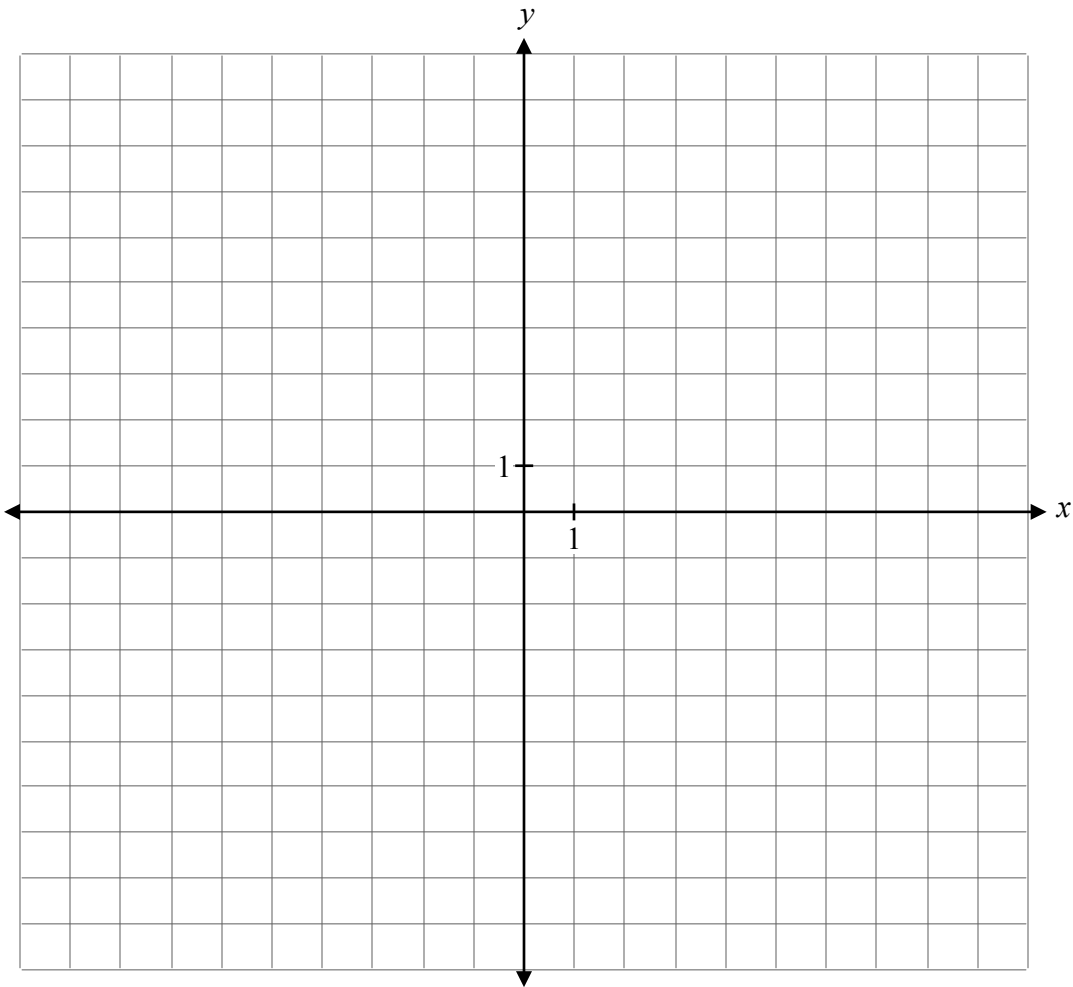
B = \_\_\_\_\_

C = \_\_\_\_\_

D = \_\_\_\_\_

(3 marks) 48. Sketch a clearly labelled graph of the conic section given by the following equation:

$$\frac{(y + 1)^2}{9} - \frac{(x - 3)^2}{4} = 1$$



- (2 marks) 49. The equation of an ellipse is  $x^2 + 2y^2 + 8y + 4 = 0$ .  
Write this equation in standard form.

- (3 marks) 50. A box contains 3 red marbles and 7 yellow marbles. Two marbles are selected at random, one after the other, without replacing the first marble in the box.
- Find the probability that both marbles are the same colour.

(3 marks) 51. Given that  $\cos \alpha = \frac{3}{4}$  and  $\sin \alpha < 0$ , find the exact value of  $\tan(2\alpha)$ .

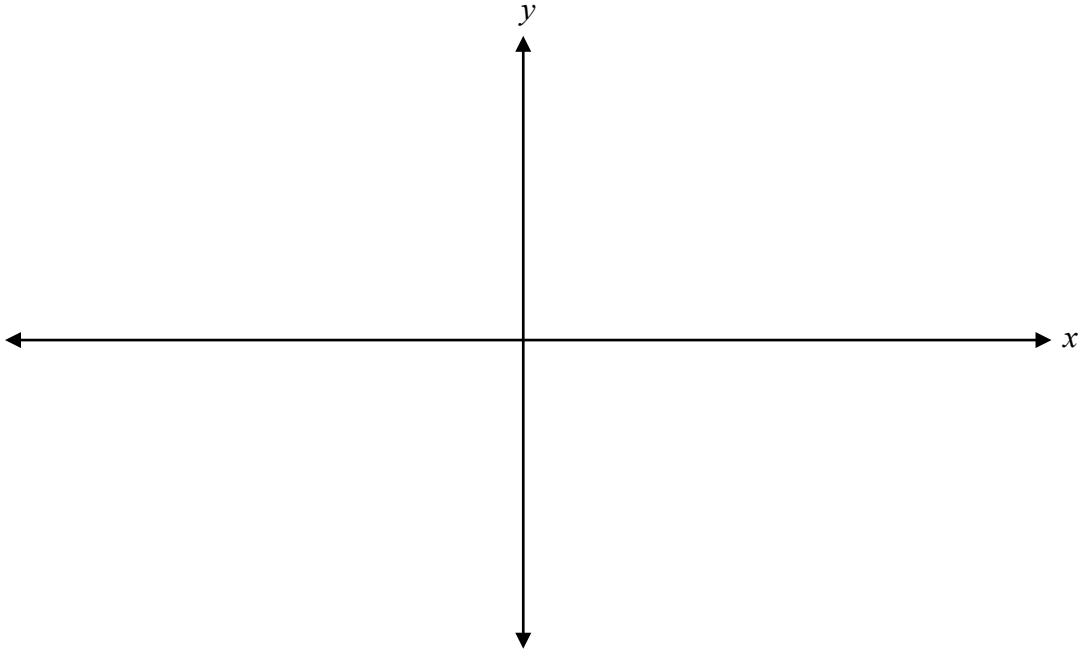
144

(2 marks) 52. Solve the following equation:

$$\log_2 x - \log_2 7 = \log_2 3$$

145

(2 marks) 53. Sketch a clearly labelled graph of at least one period of  $y = \tan x$ .



No marks will be awarded for work done on this page.

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