

Grade 12  
Pre-Calculus Mathematics  
Achievement Test

# Booklet 2

June 2014

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*Disponible en français.*

Available in alternate formats upon request.

# Instructions

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## Multiple-Choice Questions

- § There are 10 questions each worth one mark.
- § Calculators are **not** allowed for this part of the test.
- § You may use the spaces beside each question for rough work.
- § Provide only one answer per question.
- § There is no penalty for guessing.
- § Record your answers on the sheet provided.

## Short and Long Answer Questions

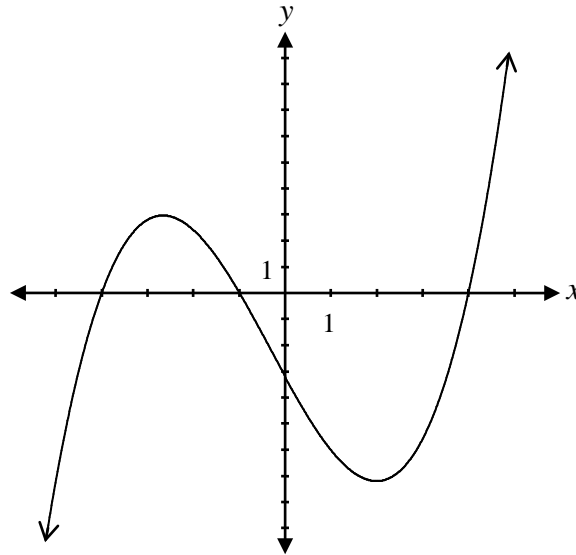
- § There are 20 questions worth a total of 44 marks.
- § Calculators are **not** allowed for this part of the test.
- § For full marks, your answer must show all pertinent diagrams, calculations, and explanations.
- § Your solutions should be neat, clear, and well organized.
- § Write each solution in the space provided.

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

Question 20

1 mark

Given the graph of the function of  $f(x)$  below, what is the range of  $y = |f(x)|$ ?



- a)  $y \in \mathbb{R}$       b)  $y \geq -7$       c)  $y \geq 0$       d)  $-4 \leq y \leq -1$  or  $y \geq 4$

Question 21

1 mark

Simplify the following expression:

$$\frac{1}{2} \log_a 36 - \log_a 2$$

- a)  $\log_a 3$       b)  $\log_a 4$       c)  $\log_a 9$       d)  $\log_a 12$

Question 22

1 mark

Given  $f(x) = x^2 - x + 2$ , an equation that represents the graph of  $f(x)$  shifted 3 units to the right is:

a)  $y = (x + 3)^2 - (x + 3) - 3$

b)  $y = (x - 3)^2 - (x - 3) + 2$

c)  $y = (x - 3)^2 - x - 2$

d)  $y = x^2 - x + 2 - 3$

Question 23

1 mark

What is the domain of the function  $y = \sqrt{-4x}$ ?

a)  $\{x \in \mathbb{R} \mid x \geq 2\}$

b)  $\{x \in \mathbb{R} \mid x \leq 2\}$

c)  $\{x \in \mathbb{R} \mid x \geq 0\}$

d)  $\{x \in \mathbb{R} \mid x \leq 0\}$

Question 24

1 mark

Which of the following is true about the two functions below?

$$f(x) = \frac{(x+2)(x-2)}{x-2} \quad g(x) = \frac{(x-2)(x+1)}{(x+2)(x-2)}$$

a) Both have a point of discontinuity (hole) when  $x = 2$ .

b) Both have the same vertical asymptote.

c) Both have the same horizontal asymptote.

d) Both have the same y-intercept.

Question 25

1 mark

The general solution to the equation  $\cos \theta = -\frac{1}{2}$  is:

a) 
$$\left. \begin{aligned} \theta &= \frac{\pi}{3} + 2\pi k \\ \theta &= \frac{5\pi}{3} + 2\pi k \end{aligned} \right\} \text{ where } k \in \mathbb{I}$$

b) 
$$\left. \begin{aligned} \theta &= \frac{\pi}{3} + \pi k \\ \theta &= \frac{5\pi}{3} + \pi k \end{aligned} \right\} \text{ where } k \in \mathbb{I}$$

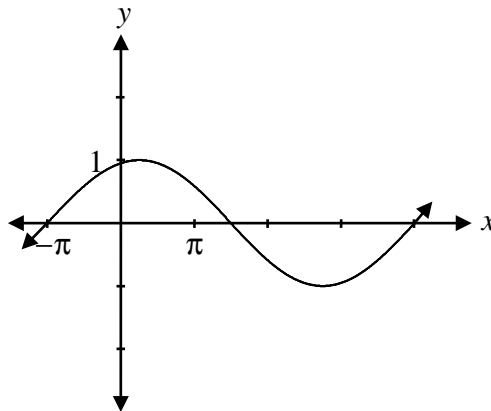
c) 
$$\left. \begin{aligned} \theta &= \frac{2\pi}{3} + 2\pi k \\ \theta &= \frac{4\pi}{3} + 2\pi k \end{aligned} \right\} \text{ where } k \in \mathbb{I}$$

d) 
$$\left. \begin{aligned} \theta &= \frac{2\pi}{3} + \pi k \\ \theta &= \frac{4\pi}{3} + \pi k \end{aligned} \right\} \text{ where } k \in \mathbb{I}$$

Question 26

1 mark

If the equation  $y = \sin(b(x + \pi))$  is represented by the following graph, what is the value of  $b$ ?



a)  $\frac{2}{5}$

b)  $\frac{5}{2}$

c)  $\frac{2\pi}{5}$

d)  $5\pi$

Question 27

1 mark

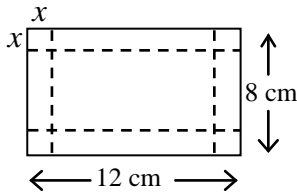
Which of the following is closest to the value of  $\log_2 40 + \log_5 125$ ?

- a) 3                      b) 8                      c) 10                      d) 45

Question 28

1 mark

A sheet of paper 12 cm long and 8 cm wide is used to make a box with no lid. Equal squares of side length  $x$  cm are cut from each of the corners and the sides are folded up to make the box.



Which of the following expresses the volume of the box?

- a)  $V(x) = x(12 + x)(8 + x)$   
b)  $V(x) = x(12 - x)(8 - x)$   
c)  $V(x) = x(12 + 2x)(8 + 2x)$   
d)  $V(x) = x(12 - 2x)(8 - 2x)$

Question 29

1 mark

Given that the graph of  $f(x)$  contains the point  $(-3, 5)$ , what point must be on the graph of  $f(-x)$ ?

- a)  $(-3, -5)$   
b)  $(3, 5)$   
c)  $(3, -5)$   
d)  $(5, -3)$



Question 30

1 mark 122

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Determine one positive and one negative coterminal angle with the angle  $\frac{5\pi}{6}$ .

Question 31

2 marks 123

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Evaluate:

$$\left(\sin \frac{11\pi}{3}\right)\left(\sec \frac{11\pi}{6}\right)$$

Question 32

1 mark

124

Given the equation  $2 \sin^2 \theta - 3 \sin \theta + 1 = 0$ , verify that  $\theta = \frac{\pi}{2}$  is a solution.

Question 33

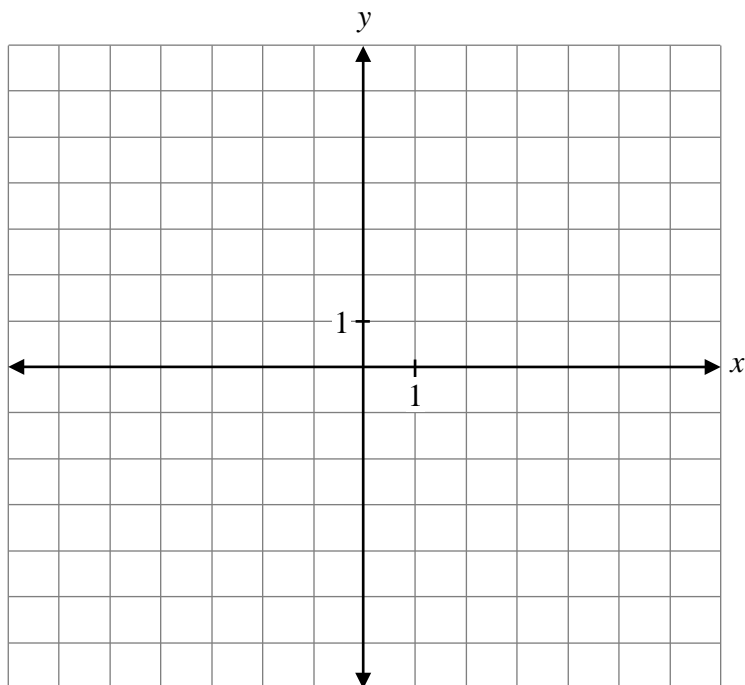
2 marks

125

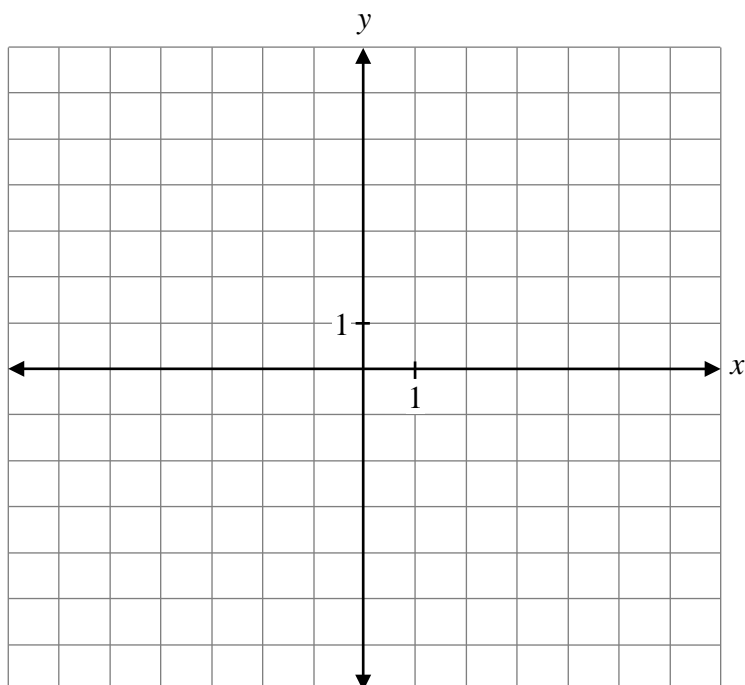
Using the laws of logarithms, expand:

$$\log_a \left( \frac{xy}{z} \right)$$

a) Sketch the graph of  $f(x) = 3^x + 1$ .



b) Sketch the graph of  $f^{-1}(x)$ .



Determine the  $x$ -intercept and  $y$ -intercept of  $y = \log_2(x + 4) - 1$ .

Explain the error that was made when solving the following equation:

$$\sin 2\theta = \cos \theta, \text{ where } \theta \in \mathbb{R}$$

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

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

$$\frac{2\sin \theta \cos \theta}{\cos \theta} = \frac{\cos \theta}{\cos \theta}$$

$$2\sin \theta = 1$$

$$\sin \theta = \frac{1}{2}$$

$$\theta = \frac{\pi}{6} + 2k\pi, \frac{5\pi}{6} + 2k\pi, k \in \mathbb{I}$$

Question 37

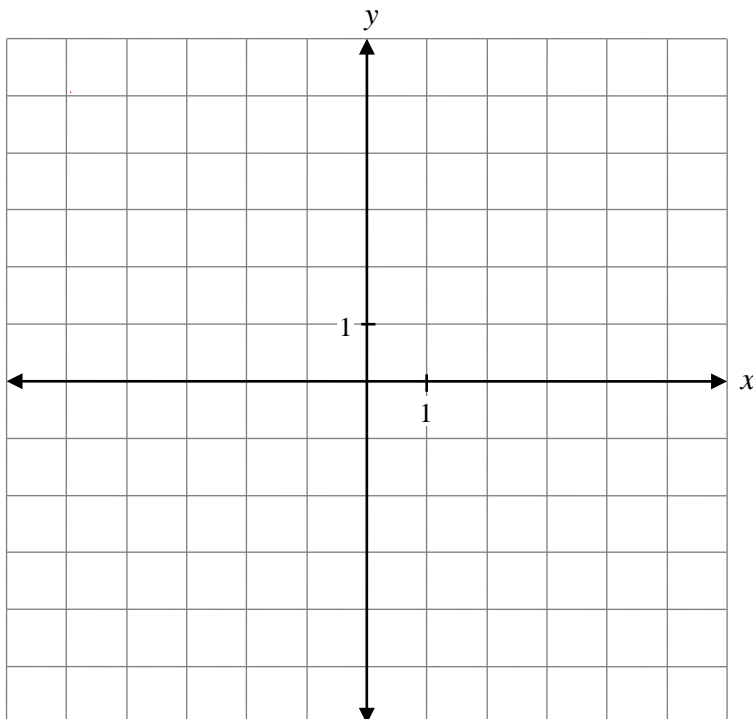
a) 1 mark b) 1 mark

130  
131

Given  $f(x) = x^2 - 2x - 3$  and  $g(x) = x + 1$ :

a) Write the equation of  $y = f(g(x))$ .

b) Sketch the graph of  $y = f(g(x))$ .



Question 38

1 mark 132

Is the point  $\left(\frac{3}{4}, -\frac{\sqrt{3}}{4}\right)$  on the unit circle?

Justify your answer.

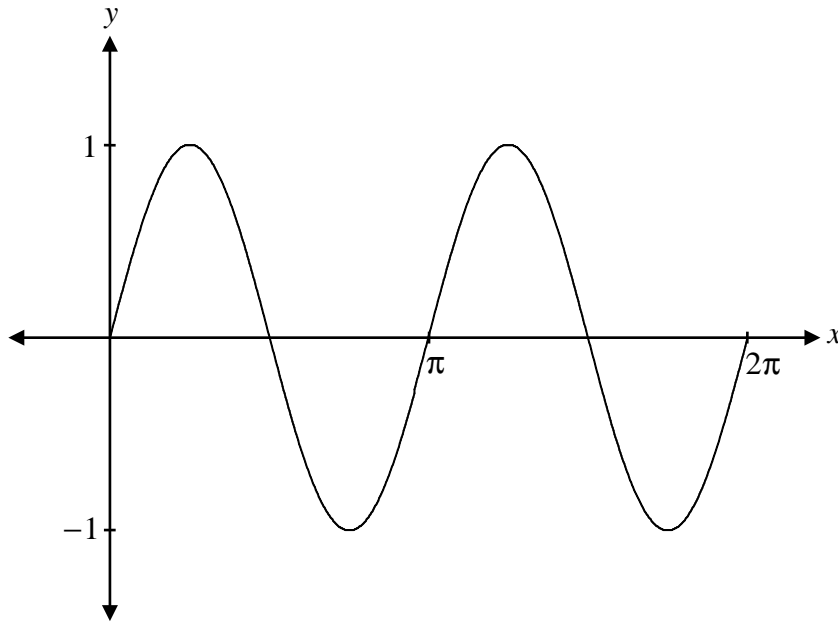
Question 39

1 mark 133

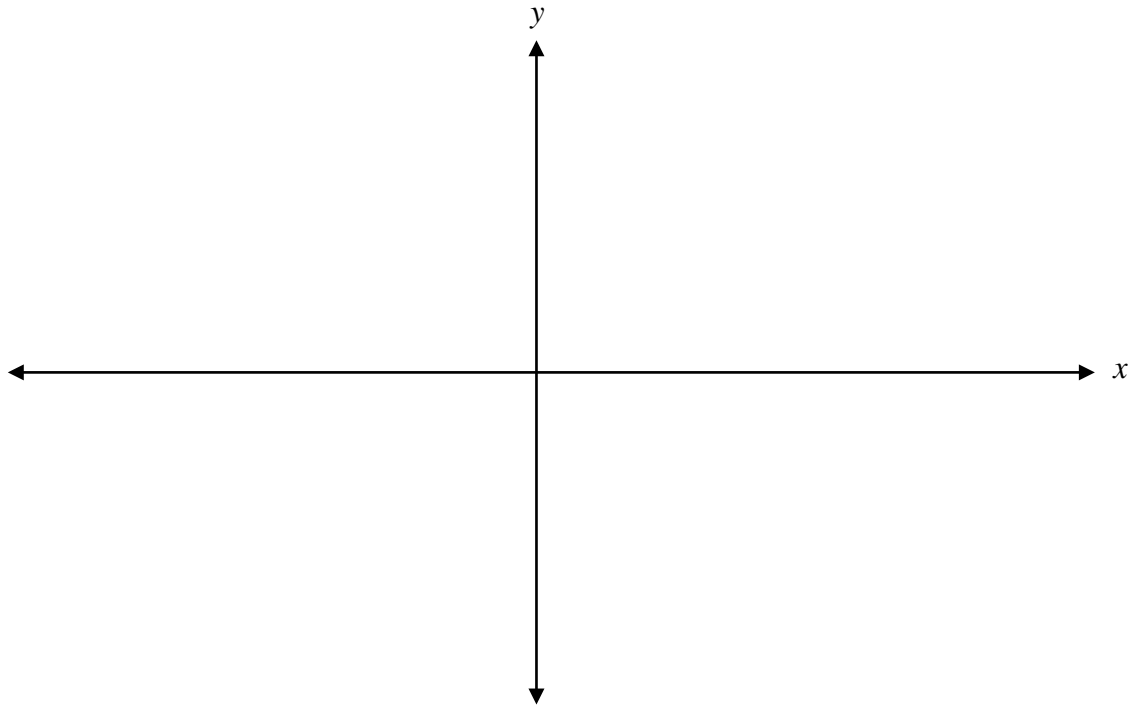
Explain why the equation  $\sec \theta = \frac{1}{4}$  has no solution.

The graph of  $y = \sin 2x$  is sketched below.

Explain how to use this graph to solve the equation  $\sin 2x = \frac{1}{2}$  over the interval  $[0, 2\pi]$ .



Sketch the graph of  $y = -4 \cos(2x)$  over the interval  $[-\pi, \pi]$ .





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Write the equation for  $f(x)$  that satisfies all of the following conditions:

- $f(x)$  is a polynomial function of degree 4
- $f(x)$  has a zero at 2 with a multiplicity of 3
- $f(x)$  has a zero at  $-5$
- $f(x)$  has a y-intercept of 80

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Find the exact value of  $\sin\left(\frac{19\pi}{12}\right)$ .

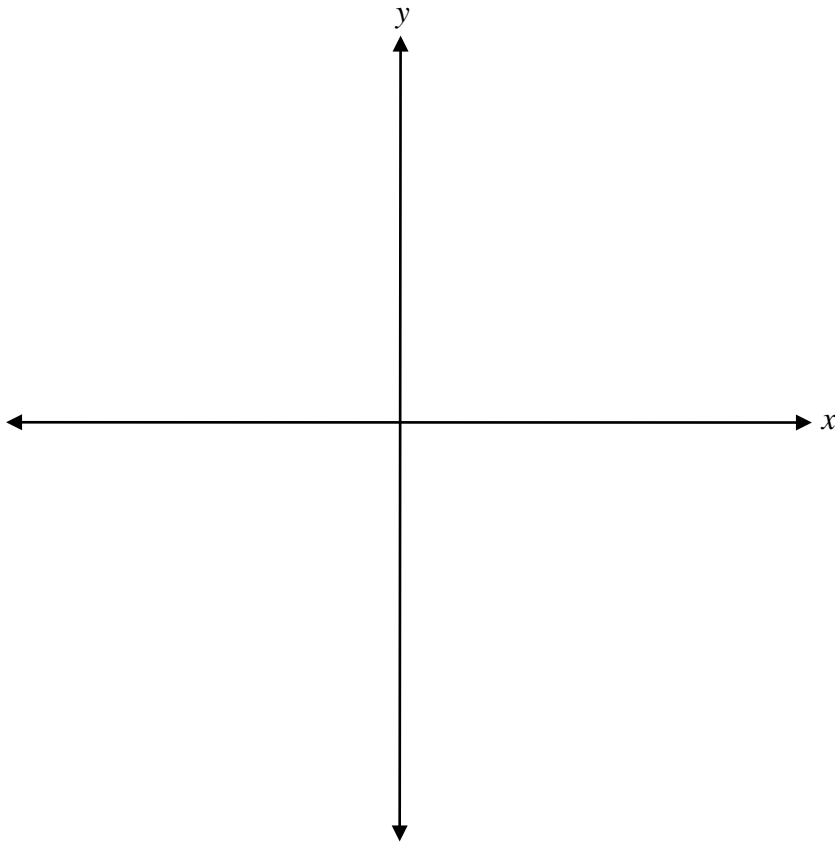
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Solve the following equation:

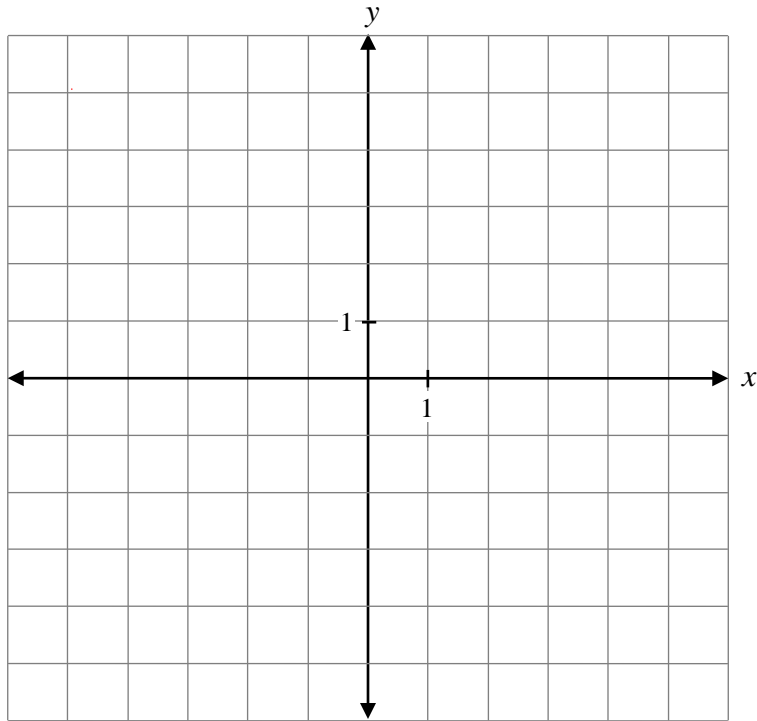
$$2\log_2(x-1) - \log_2(x-5) = \log_2(x+1)$$

Sketch the graph of  $f(x) = (x - 1)^2(x + 2)^3$ .

Label the  $x$ -intercepts and the  $y$ -intercept.



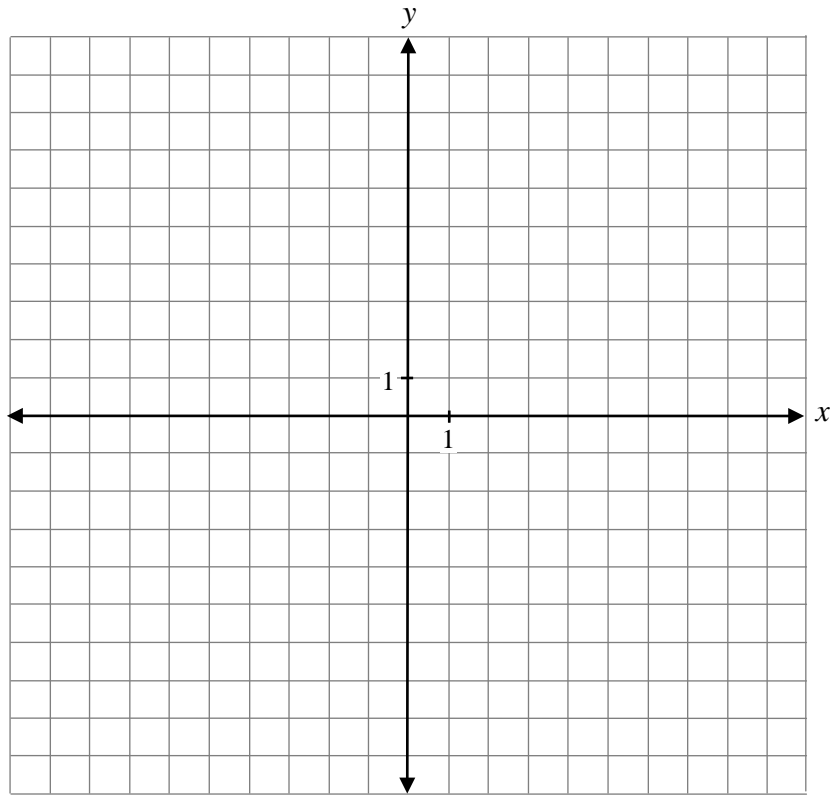
Sketch the graph of  $y = -\sqrt{3(x+1)}$ .



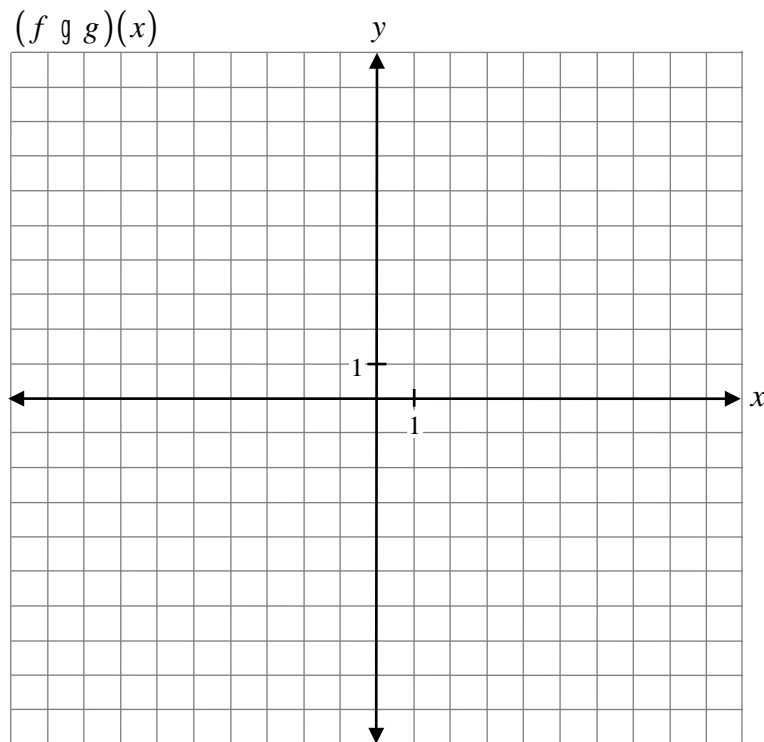
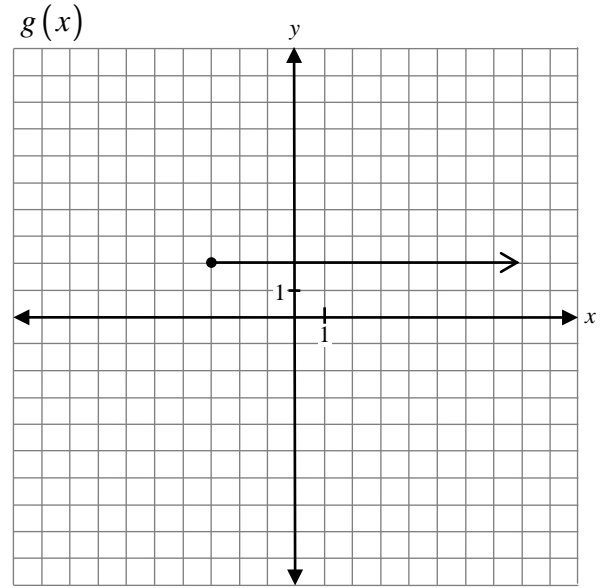
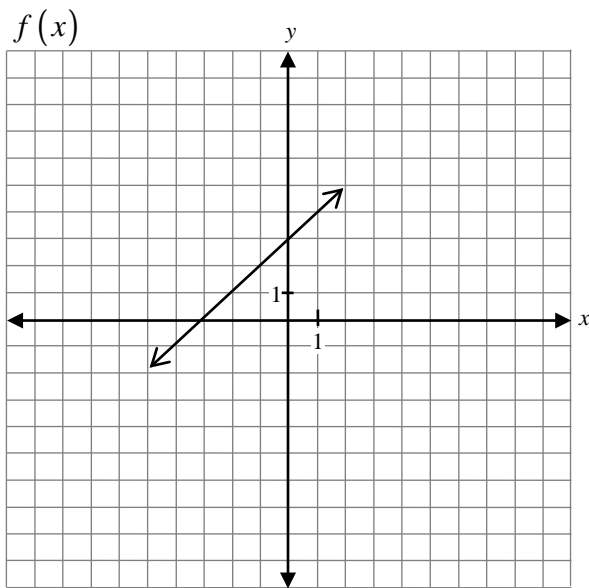
Solve:

$${}_{n-1}P_2 = 42$$

Sketch the graph of  $y = \frac{2x}{x+2}$ .

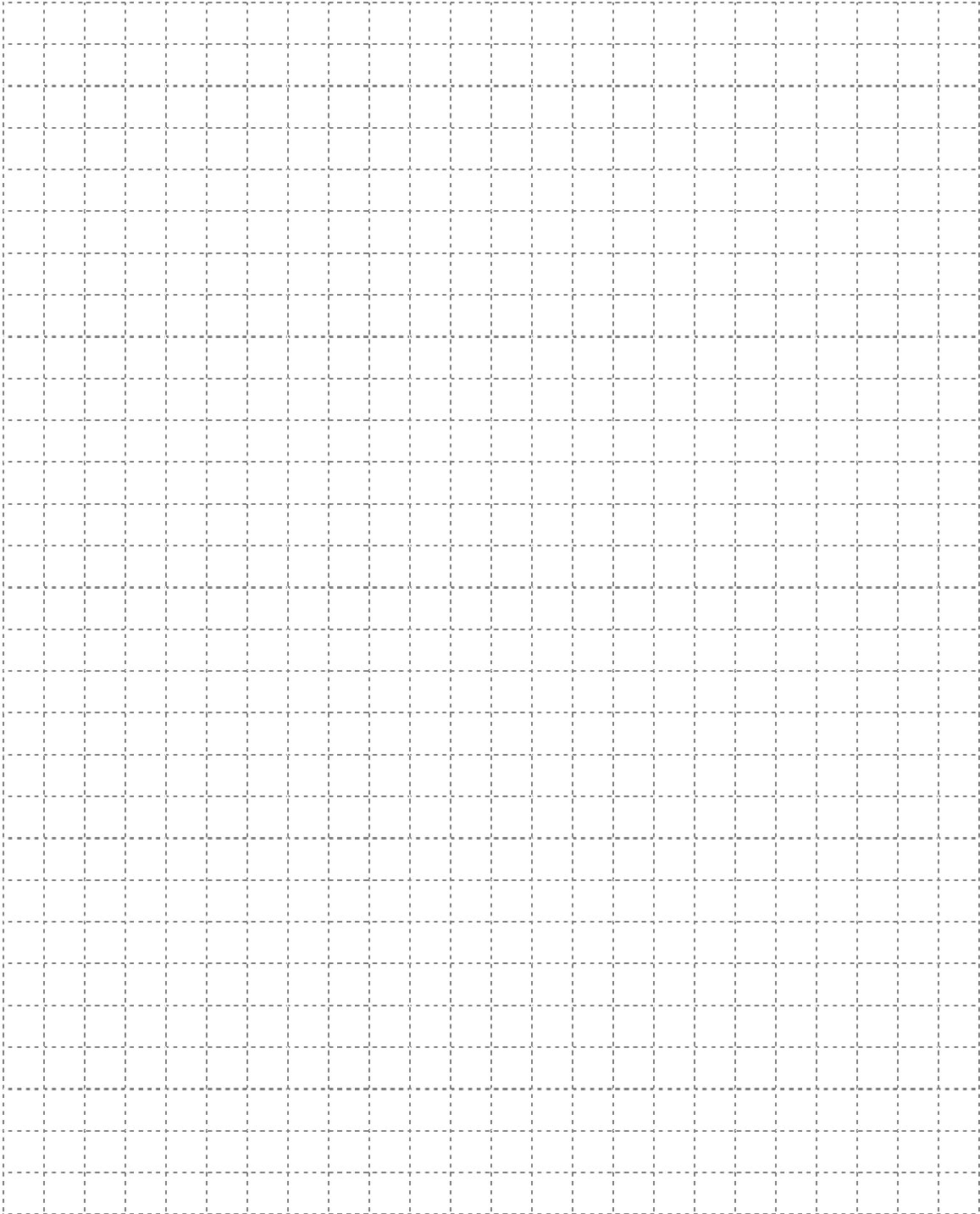


Given the graphs of  $f(x)$  and  $g(x)$ , sketch the graph of  $(f \circ g)(x)$ .





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