

Grade 12  
Pre-Calculus Mathematics  
Achievement Test

# **Booklet 2**

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*Disponible en français.*

Available in alternate formats upon request.

# Instructions

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## Multiple-Choice Questions

- There are 9 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 25 questions worth a total of 49 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.

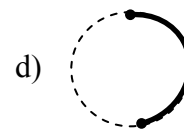
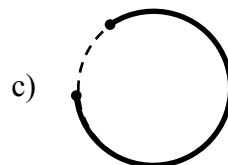
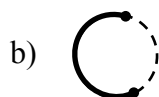
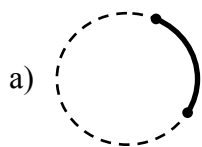
**Question 16****1 mark**

If  $(2, 3)$  is a point on the graph of  $y = f(x)$ , what point must be on the graph of  $y = 3f\left(\frac{1}{4}x\right)$ ?

- a)  $\left(\frac{1}{2}, 1\right)$       b)  $\left(\frac{1}{2}, 9\right)$       c)  $(8, 1)$       d)  $(8, 9)$

**Question 17****1 mark**

Consider the arc drawn on each circle. Which arc measure is closest to 3 radians?

**Question 18****1 mark**

If  $\log_2 x = 4$ , then  $\log_2(2x)$  is equal to:

- a) 5      b) 8      c) 16      d) 32

Question 19

1 mark

Simplify the following expression:

$$\cos^2 x (1 + \cot^2 x)$$

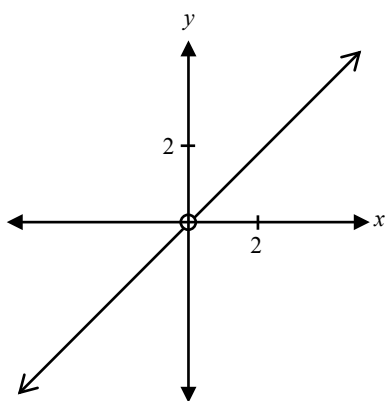
- a)  $\sin^2 x$                       b)  $\cos^2 x$                       c)  $\cot^2 x$                       d)  $\sec^2 x$

Question 20

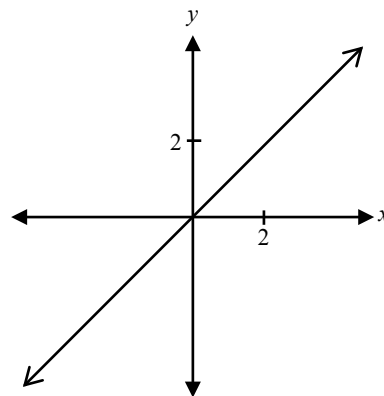
1 mark

Identify the graph of the function  $y = \frac{x}{x}$ .

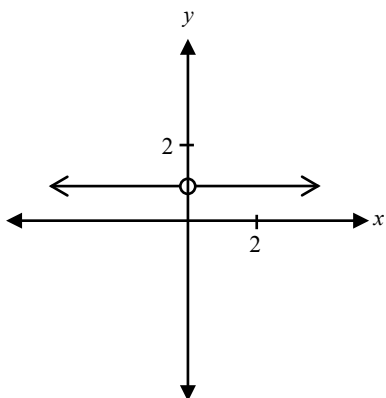
a)



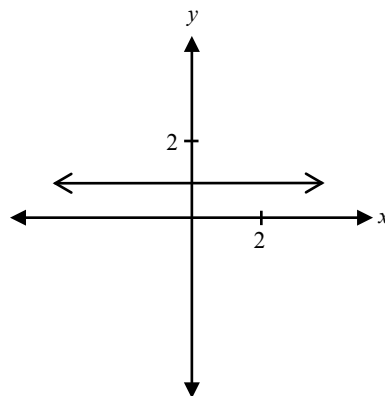
b)



c)



d)



**Question 21****1 mark**

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How many terms are in the expansion of  $(3y^2 - 4z)^7$ ?

- a) 2                      b) 6                      c) 7                      d) 8

**Question 22****1 mark**

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Determine one possible restriction for the domain of  $y = (x + 3)^2 - 4$  so that its inverse is a function.

- a)  $x \leq -3$                       b)  $x \leq 0$                       c)  $x \leq 3$                       d)  $x \leq 4$

**Question 23****1 mark**

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Find the total possible number of arrangements for 7 adults and 3 children seated in a row if the 3 children must sit together.

- a)  $10!$                       b)  $8!3!$                       c)  $7!3!$                       d)  $7!$

**Question 24****1 mark**

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Identify the value of the  $x$ -intercept of the function  $y = \ln(x - 2)$ .

- a)  $-1$                       b)  $0$                       c)  $2$                       d)  $3$

**Question 25****1 mark**

116

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Given  $\log_b a = 3$ , give one example of possible values for  $a$  and  $b$  that make this equation true.

**Question 26****1 mark**

117

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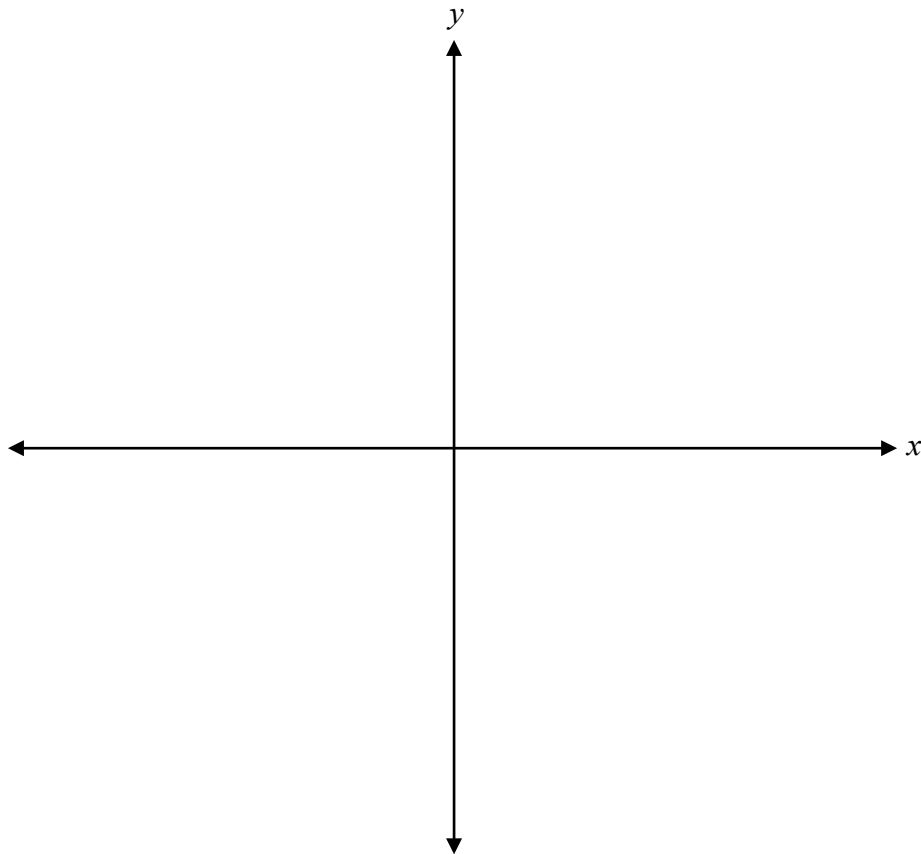
The range of the graph of  $y = f(x)$  is  $[-3, 2]$ .

Explain why there is no effect on the range of the graph that is a result of the transformation  $y = f(-x)$ .



Sketch the graph of  $y = (x + 1)(x - 2)^2(x + 5)$ .

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



$x$ -intercepts: \_\_\_\_\_

$y$ -intercept: \_\_\_\_\_

**Question 28****2 marks**

119

The graph of the function  $y = \sin x$  has been transformed to create a new graph.

The range of this new graph is  $[-4, 4]$  and the zeros are  $x = k\frac{\pi}{2}$ , where  $k$  is an integer.

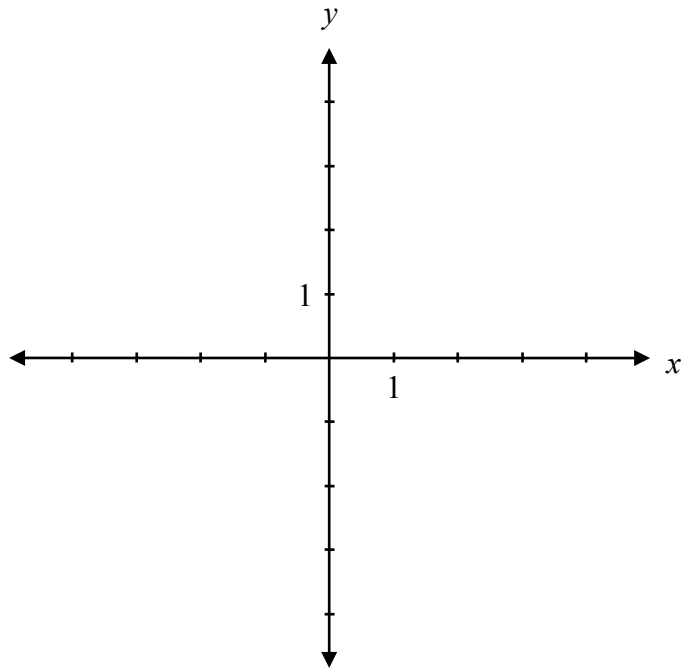
Write the equation that corresponds to this new graph.

**Question 29****1 mark**

120

Given the functions  $f(x) = x^2 - 1$  and  $g(x) = x + 1$ , state the domain of  $\frac{g(x)}{f(x)}$ .

a) Sketch the graph of  $y = 3^x$ .



b) Explain how the graph of  $y = 3^x$  can be used to sketch the graph of  $y = \log_3 x$ .

### Question 31

5 marks

123

A box in the shape of a rectangular prism has side lengths  $x$ ,  $x + 2$ , and  $x + 10$ .

Write a function,  $V(x)$ , to express the volume of the box in terms of  $x$ .

Find all possible values of  $x$ , given that the volume of the box is  $96 \text{ cm}^3$ .

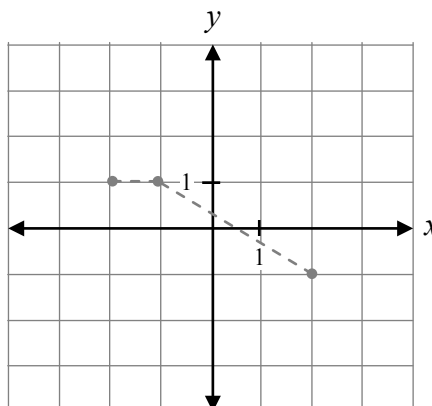
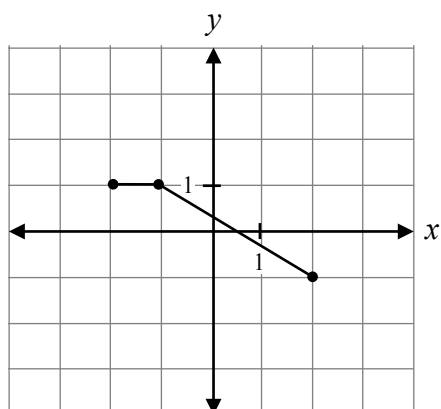
State the dimensions of the box.

Question 32

1 mark

124

Given the graph of  $f(x)$  below, sketch the graph of  $y = -f(x)$ .



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

Question 33

1 mark

125

Determine the coordinates of a point  $(x, y)$  on the unit circle if you are given  $\theta = 30^\circ$  where  $\theta$  is in standard position.

Given the following sinusoidal equation:

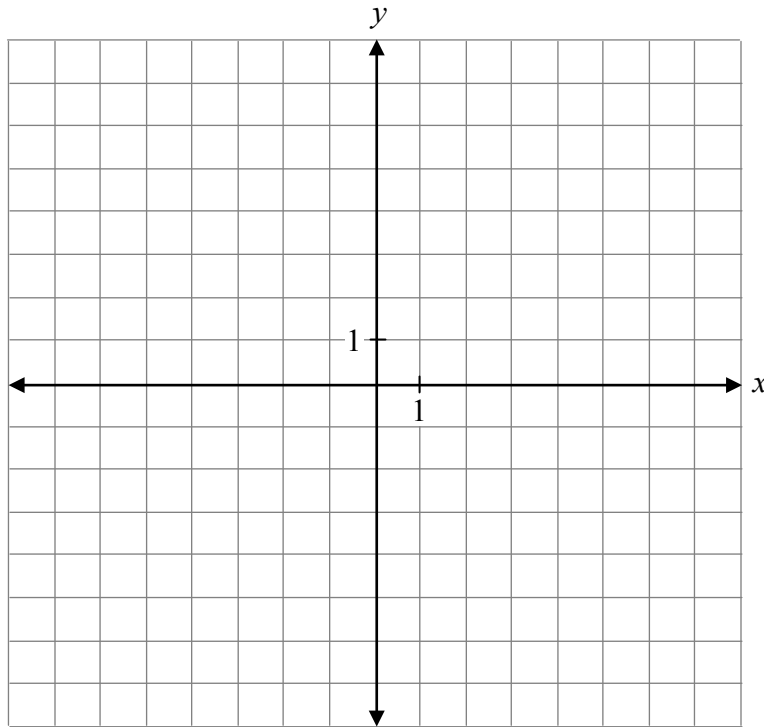
$$P(t) = 3000 \sin \left[ \frac{\pi}{10}(t - 2010) \right] + 10\,000$$

Determine the maximum value of  $P(t)$  and a value of  $t$  at which this maximum occurs.

Maximum value of  $P(t)$ : \_\_\_\_\_

Value of  $t$ : \_\_\_\_\_

Sketch the graph of  $y = \sqrt{2x - 2}$ .



### Question 36

2 marks

128

Given  $f(x) = 2x - 6$ , write the equation of  $f^{-1}(x)$ .

### Question 37

1 mark

129

Frank tried to expand a logarithmic expression using the laws of logarithms. He made one error.

*Frank's solution:*  $\log_a \frac{(x+2)}{zw} = \log_a x + \log_a 2 - \log_a z - \log_a w$

Write the correct solution.



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Determine all non-permissible values of  $\theta$  over the interval  $[0, 2\pi]$ .

$$\frac{\sin \theta}{1 + \cos \theta} + \csc \theta + \cot \theta$$

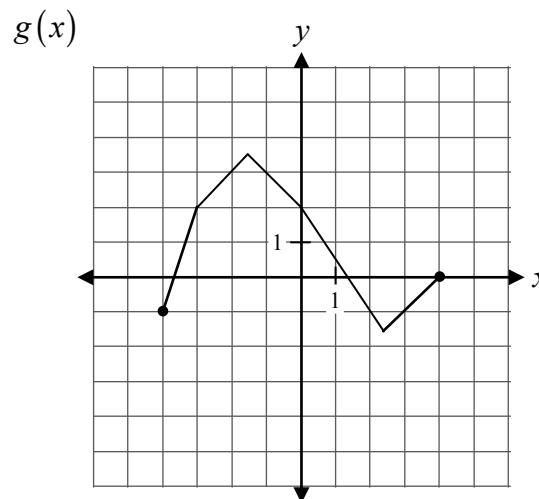
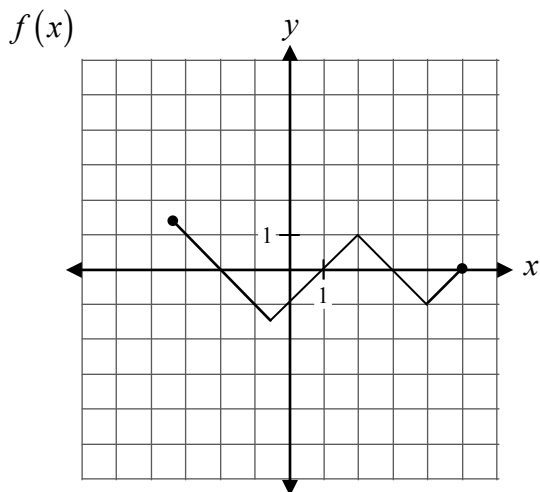
Explain your reasoning.

Question 39

a) 1 mark   b) 1 mark   c) 1 mark

131  
132  
133

Given the following graphs:



a) Determine the value of  $[f \cdot g](0)$ .

b) Determine the value of  $g(f(4))$ .

c) Determine a value for  $k$  where  $f(k) = 1$ .

## Question 40

1 mark

134

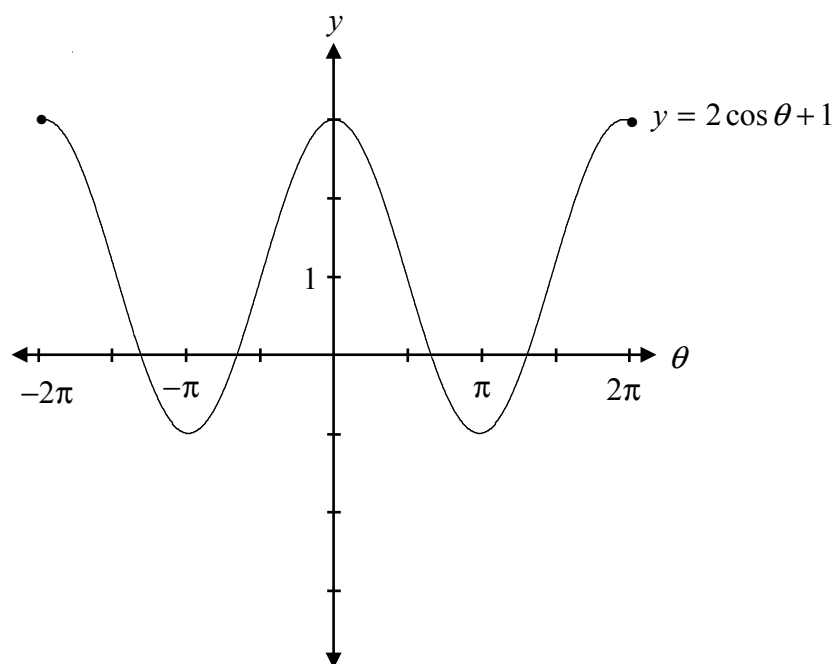
Given that  $h(x) = 2x^2 + 5x - 3$  and that  $h(x) = f(x) \cdot g(x)$ , determine  $f(x)$  and  $g(x)$ .

## Question 41

1 mark

135

The graph of  $y = 2 \cos \theta + 1$  below can be used to solve the equation  $\cos \theta = -\frac{1}{2}$  over the interval  $[-2\pi, 2\pi]$ . Indicate on the graph where to find the solutions to the equation  $\cos \theta = -\frac{1}{2}$ .



**Question 42****1 mark**

136

The function  $f(x)$  is transformed.

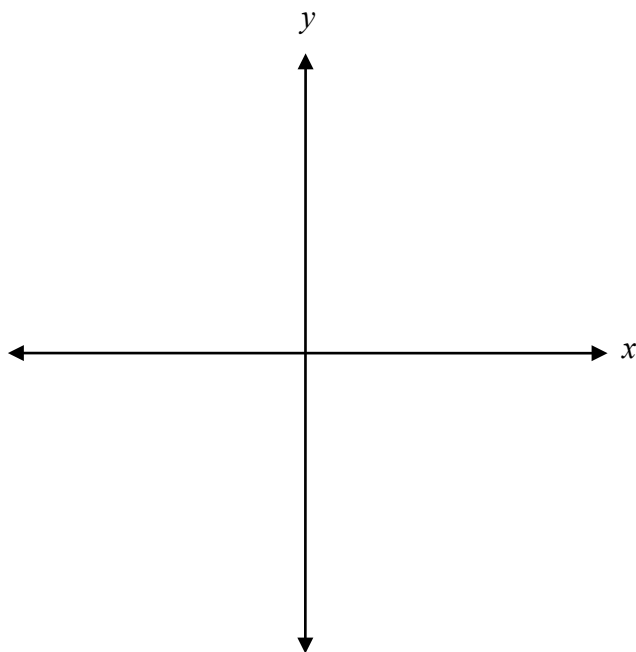
A new function,  $y = \frac{1}{f(x)}$ , is created that does not have any vertical asymptotes.

What can you conclude about the original function  $f(x)$ ?

**Question 43****1 mark**

137

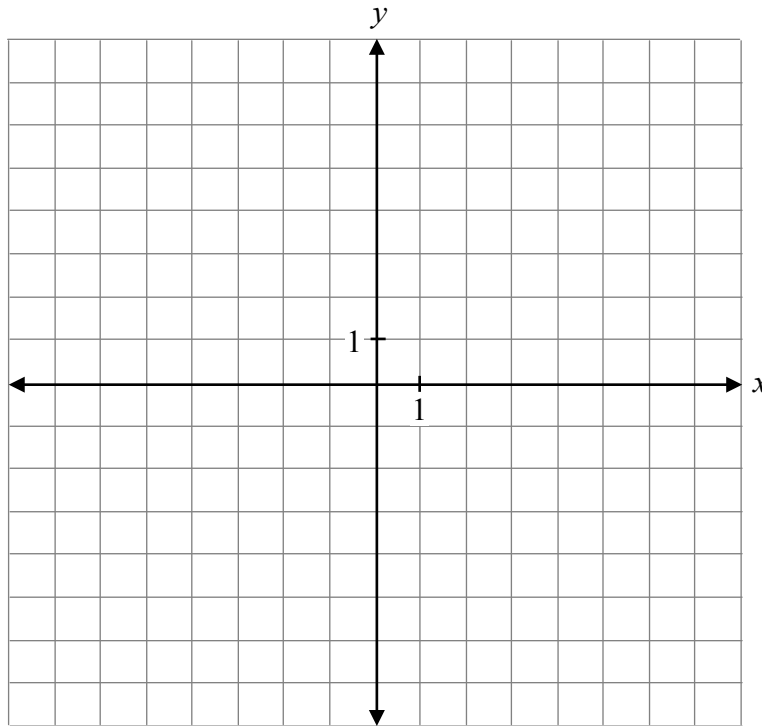
Draw the angle  $-\frac{7\pi}{8}$  in standard position.



Determine the exact value of:

$$4 \cos\left(\frac{11\pi}{12}\right)$$

Sketch the graph of  $f(x) = \frac{x-4}{x^2-3x-4}$ .



**Question 46****1 mark**

140

Estimate the value of  $\log_5 35$ .

Justify your answer.

**Question 47****1 mark**

141

If  $p(x) = x^5 - 12x + 1$ , determine the remainder when  $p(x)$  is divided by  $(x + 2)$ .

**Question 48****1 mark**

142

Describe the effects on the graph of  $y = f(x)$  when asked for the graph of  $y = f(x - 3) + 5$ .

**Question 49****3 marks**

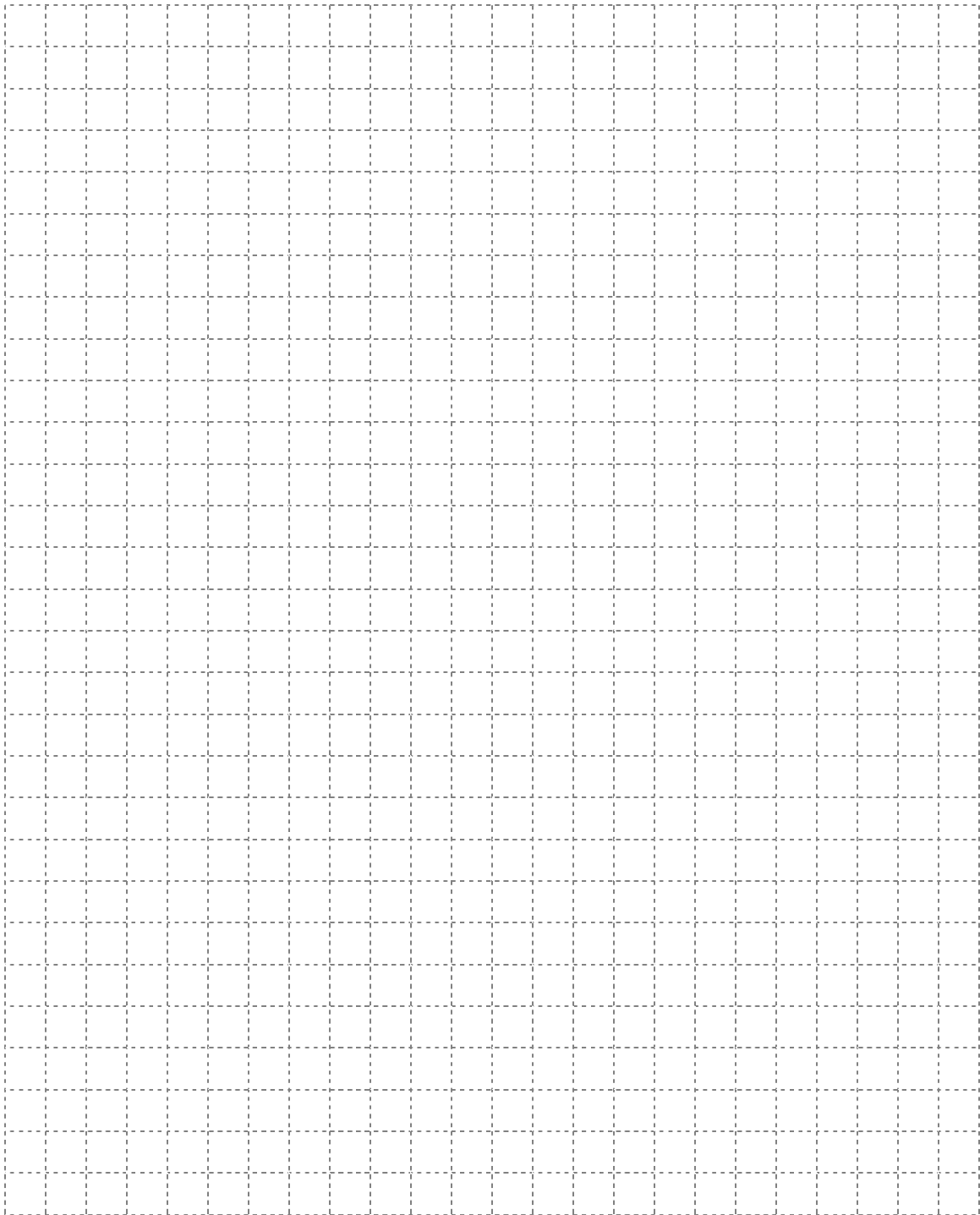
143

Find the exact value of the following expression:

$$\sin\left(\frac{11\pi}{3}\right) \cdot \sec\left(\frac{4\pi}{3}\right) \cdot \tan\left(-\frac{5\pi}{6}\right)$$



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



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