

Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

January 2013

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Instructions

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.

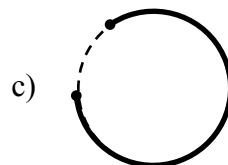
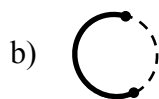
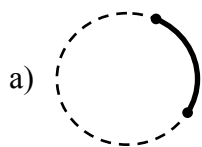
Question 16**1 mark**

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:

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

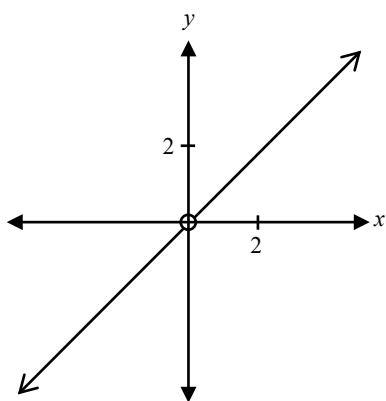
- a) $\sin^2 x$ b) $\cos^2 x$ c) $\cot^2 x$ d) $\sec^2 x$

Question 20

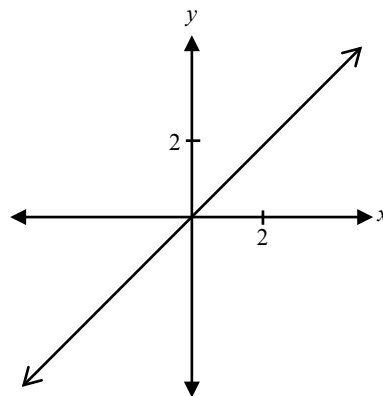
1 mark

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

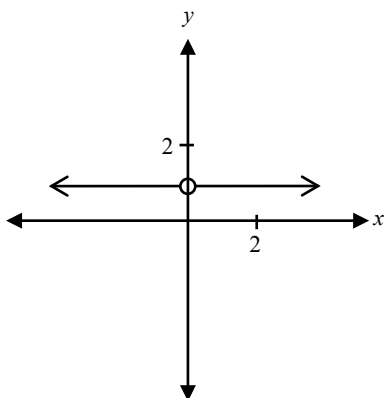
a)



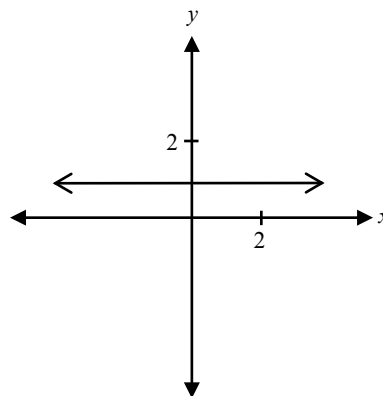
b)



c)



d)



Question 21**1 mark**

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

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

Question 22**1 mark**

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**

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**

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

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

Question 26**1 mark**

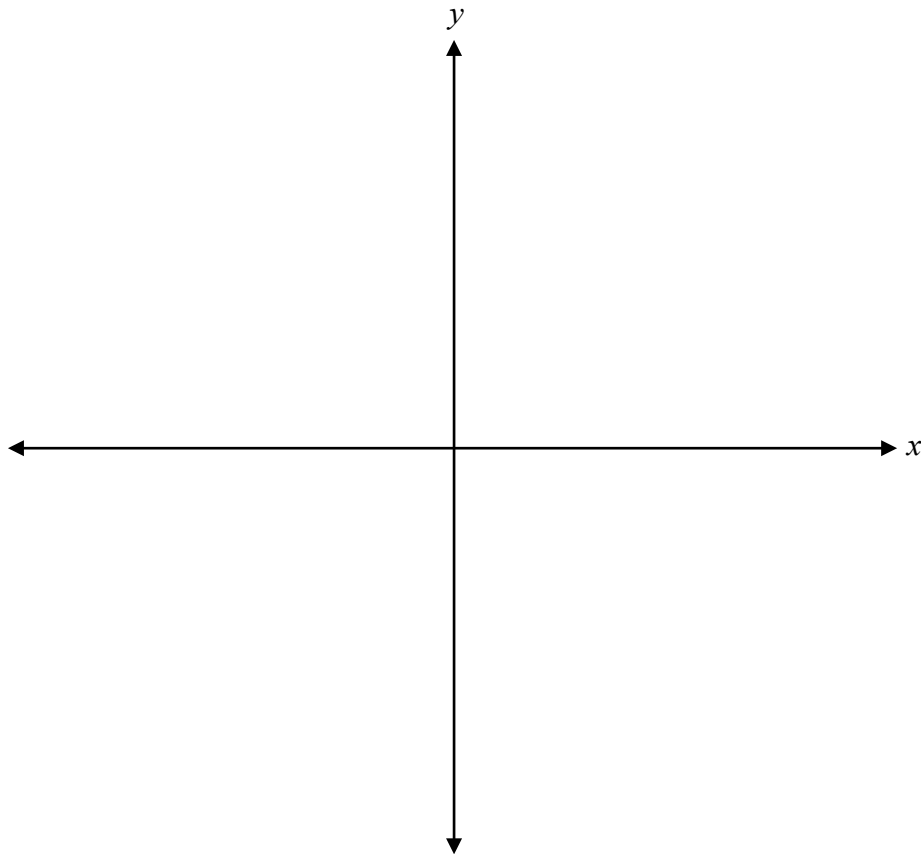
117

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.

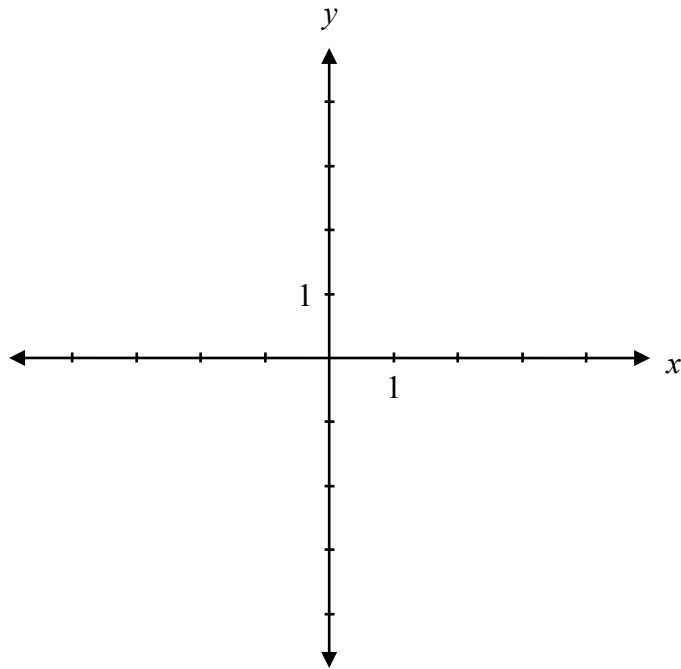
Write the equation that corresponds to this new graph.

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 cm^3 .

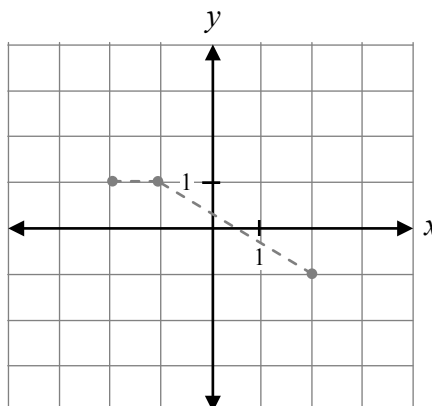
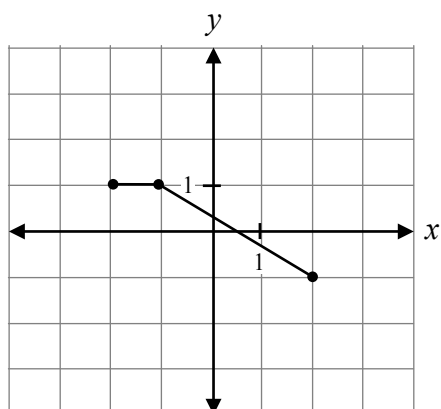
State the dimensions of the box.

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 θ is in standard position.

Given the following sinusoidal equation:

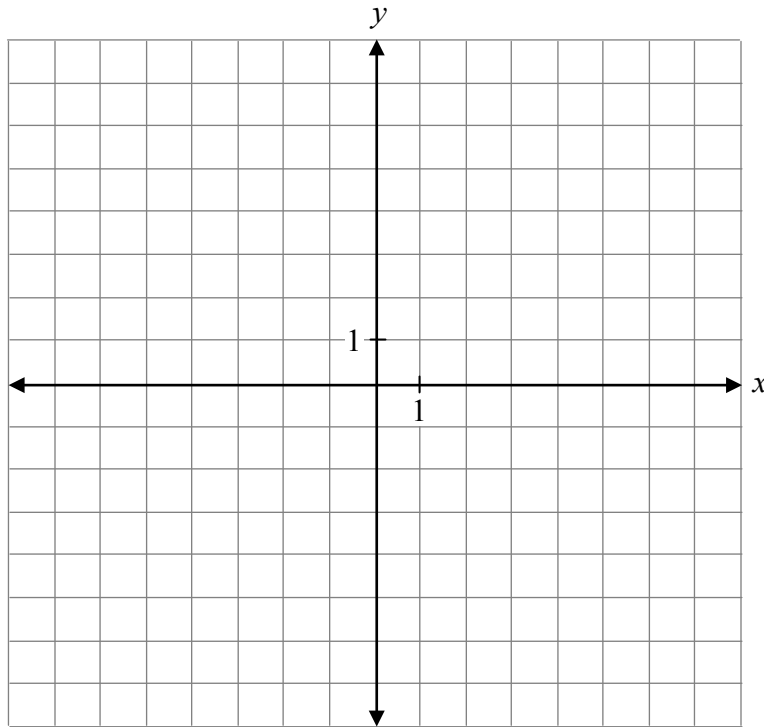
$$P(t) = 3000 \sin \left[\frac{\pi}{10}(t - 2010) \right] + 10\,000$$

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.

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

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

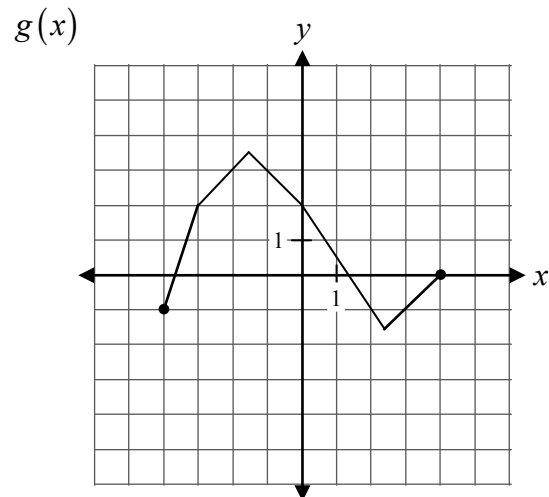
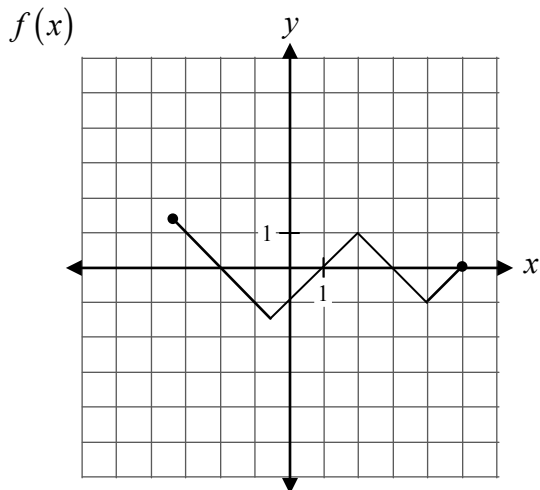
Explain your reasoning.

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

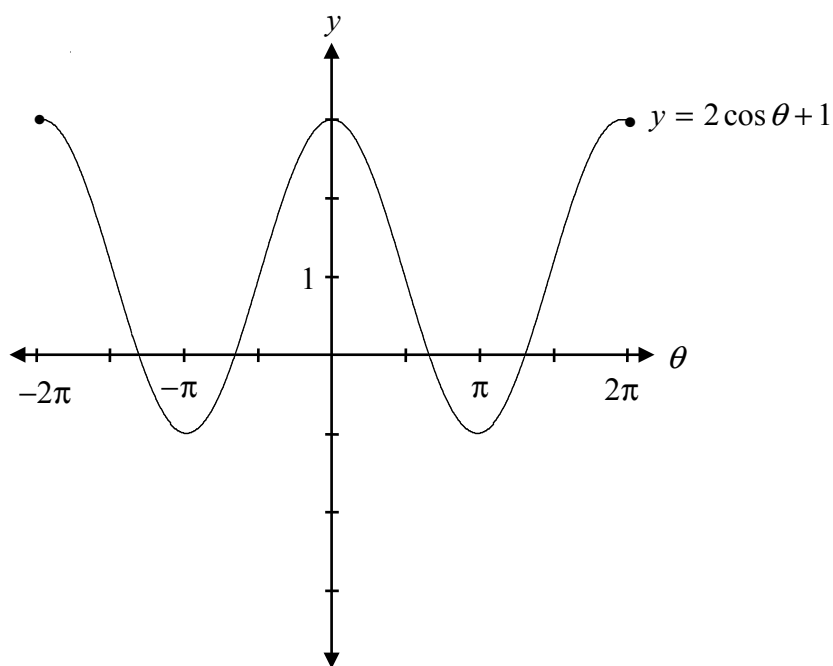
Given that $h(x) = 2x^2 + 5x - 3$ and that $h(x) = f(x) \cdot g(x)$, determine $f(x)$ and $g(x)$.

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.

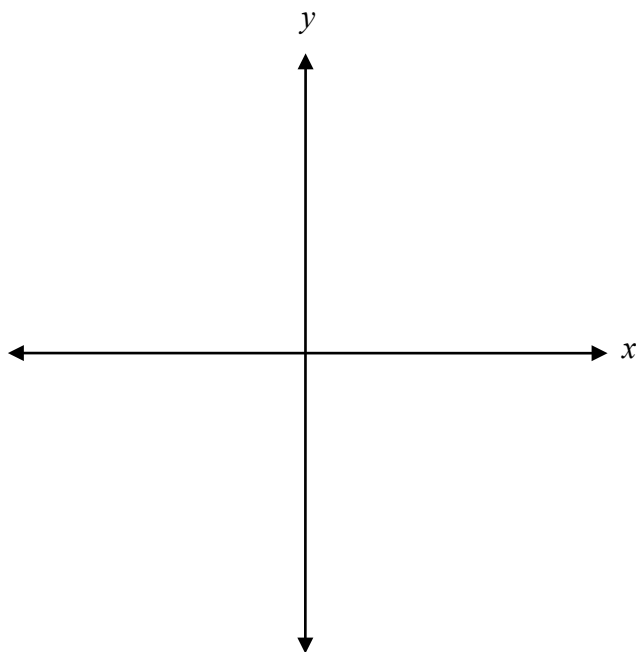
A new function, $y = \frac{1}{f(x)}$, is created that does not have any vertical asymptotes.

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:

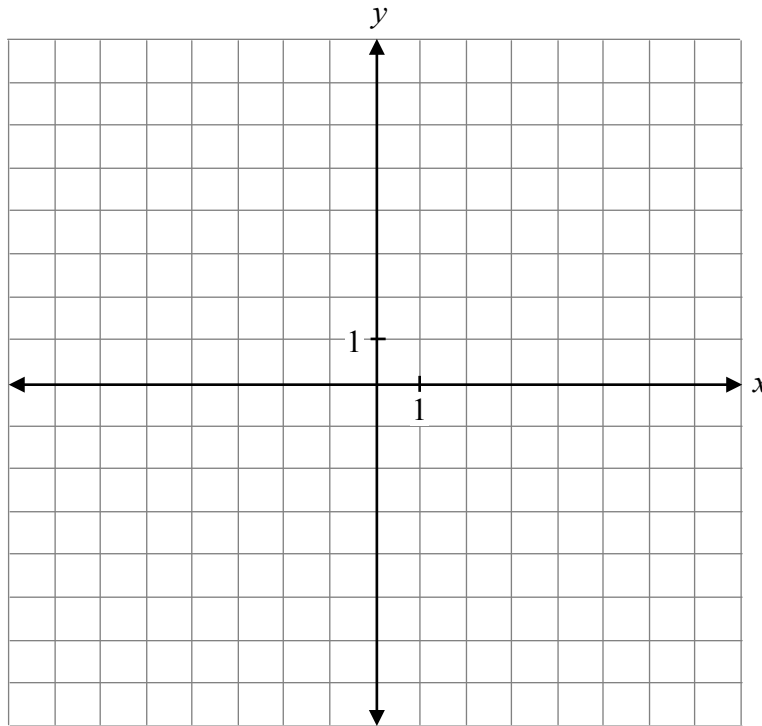
$$4 \cos\left(\frac{11\pi}{12}\right)$$

Question 45

3 marks

139

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 $y = f(x - 3) + 5$.

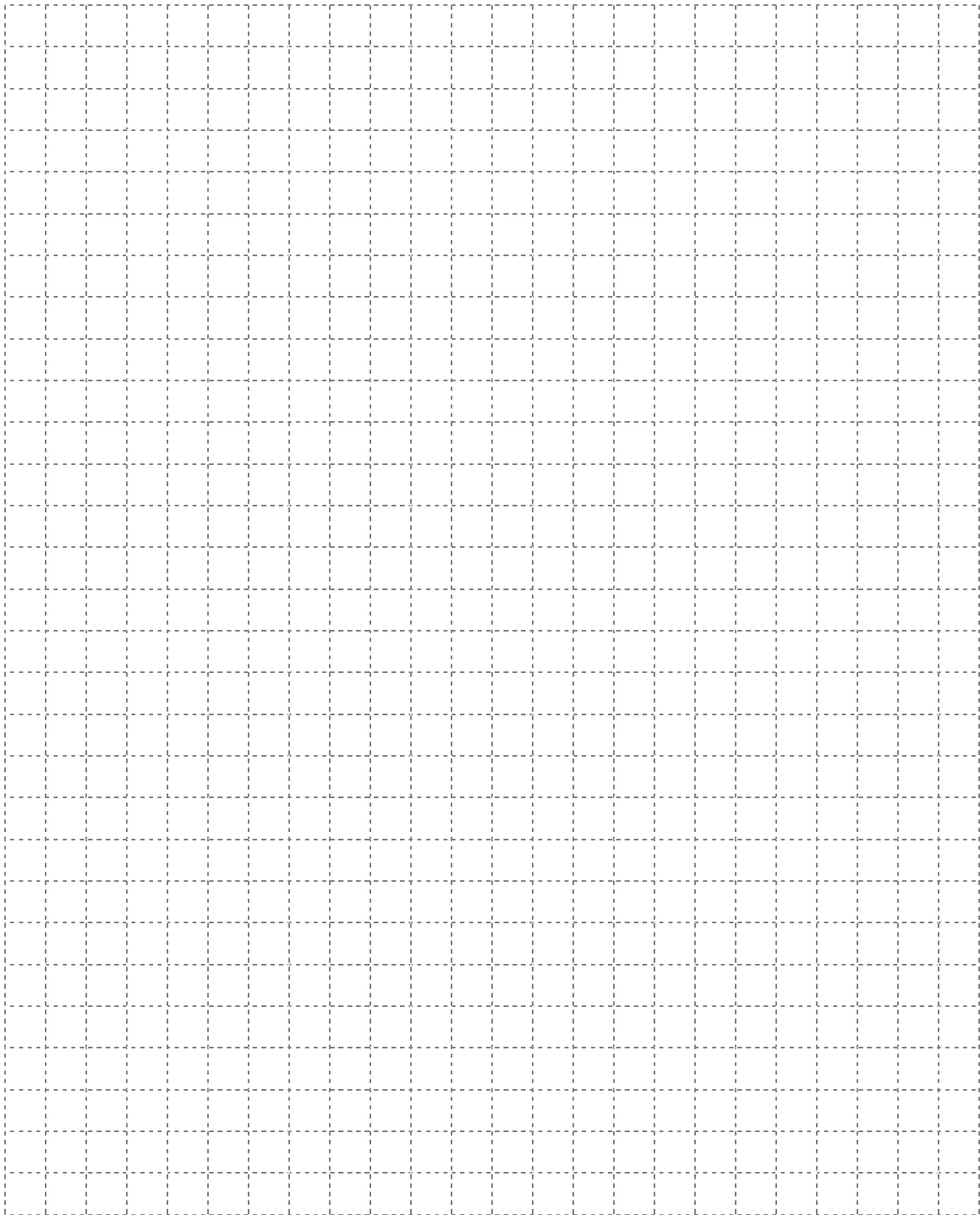
Question 49**3 marks**

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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