

Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

June 2024

Grade 12 pre-calculus mathematics achievement test.
Booklet 2. June 2024

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Available in alternate formats upon request.

Grade 12 Pre-Calculus Mathematics Achievement Test

DESCRIPTION

Time Required to Complete the Test: 3 hours

Additional Time Allowed: 30 minutes

Numbers and Marks by Question Type

	Selected Response	Constructed Response	Marks
Booklet 1	—	16	34
Booklet 2	10	21	56
Total	10	37	90

Note that diagrams and graphs provided in the test booklets may not be drawn to scale.

DIRECTIONS

Selected Response Questions

- 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.

Constructed Response Questions

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

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

Question 17**1 mark**

Given that the point $(-13, 7)$ is on the graph of $y = f(x)$, identify the corresponding point on the graph of $y = f^{-1}(x+2)$.

- a) $(7, -11)$
- b) $(5, -13)$
- c) $(7, -15)$
- d) $(9, -13)$

Question 18**1 mark**

Given that $x = 0$, $x = 1$, $x = 2$ and $x = -3$ are zeros of the polynomial function $p(x)$, identify a possible equation for $p(x)$.

- a) $p(x) = -3x(x+1)(x-2)$
- b) $p(x) = (x+1)(x+2)(x-3)^2$
- c) $p(x) = x(x+3)^2(x-1)(x-2)$
- d) $p(x) = (x-2)(x-1)^3(x+3)$

Question 19**1 mark**

Identify the interval where the angle, θ , could exist if $\cos \theta = -\frac{4}{5}$ and $\csc \theta = \frac{5}{3}$.

- a) $\left(0, \frac{\pi}{2}\right)$
- b) $\left(\frac{\pi}{2}, \pi\right)$
- c) $\left(\pi, \frac{3\pi}{2}\right)$
- d) $\left(\frac{3\pi}{2}, 2\pi\right)$

Question 20**1 mark**

Identify a non-permissible value of θ in the identity, $\frac{\cot \theta}{\csc \theta} = \cos \theta$.

- a) π
- b) $\frac{\pi}{4}$
- c) $\frac{3\pi}{2}$
- d) $\frac{\pi}{2}$

Question 21**1 mark**

Identify the solution of the equation, $e^{2x} = 16$.

- a) $x = \ln 8$
- b) $x = 8$
- c) $x = \frac{\ln 16}{2}$
- d) $x = \frac{\log 16}{2}$

Question 22**1 mark**

A committee of 6 people is to be selected from 90 students. Identify an expression that represents the number of possible committees if two of the students, Evelyn and Wayne, must be on the committee.

- a) ${}_{90}C_4$
- b) ${}_{90}C_6$
- c) ${}_{88}C_6$
- d) ${}_{88}C_4$

Question 23**1 mark**

Identify the expression for the number of arrangements of the letters in the word RUSSELL.

- a) $\frac{7!}{4!}$
- b) $7!$
- c) $\frac{7!}{2!}$
- d) $\frac{7!}{2!2!}$

Question 24**1 mark**

Given the row of Pascal's triangle below, identify the third value of the next row.

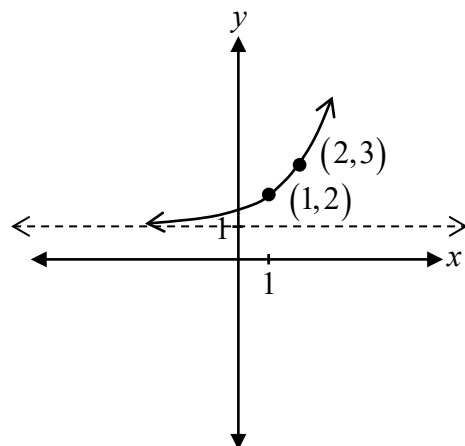
1 7 21 35 35 21 7 1

- a) 8
- b) 28
- c) 56
- d) 70

Question 25**1 mark**

Identify the equation represented by the graph sketched below.

- a) $y = \left(\frac{1}{2}\right)^x + 1$
- b) $y = 2^{x-1} + 1$
- c) $y = 2^{x+1} + 1$
- d) $y = \left(\frac{1}{2}\right)^{x+1} + 1$



Match the following functions with their correct graphs.

Place the appropriate letter in this column.

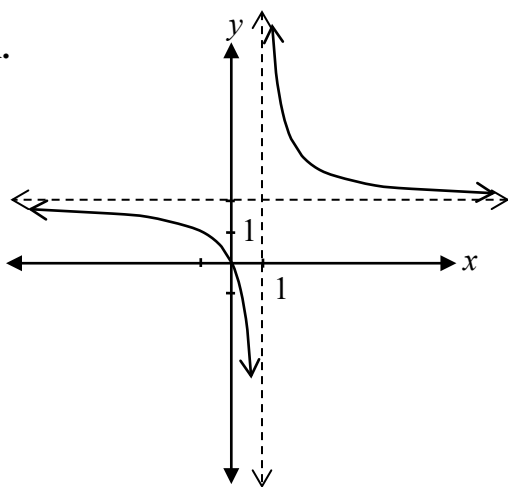
$$f(x) = \frac{1}{x-2}$$

$$g(x) = \frac{-x}{x-2}$$

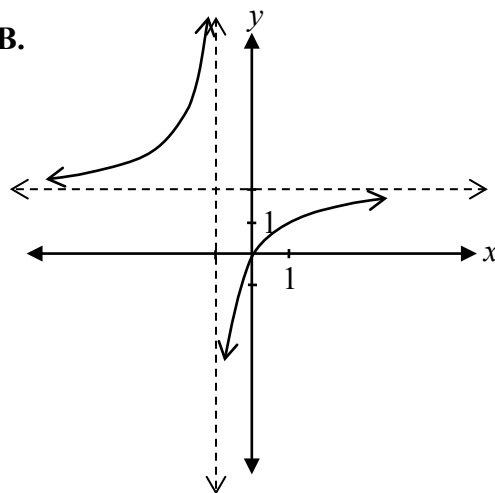
$$h(x) = \frac{2x}{x-1}$$

$$k(x) = \frac{2x}{x+1}$$

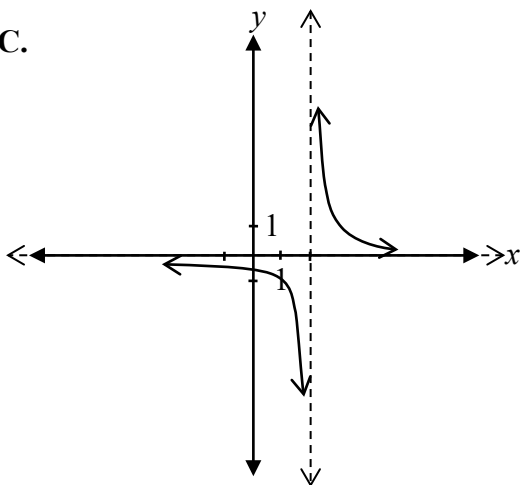
A.



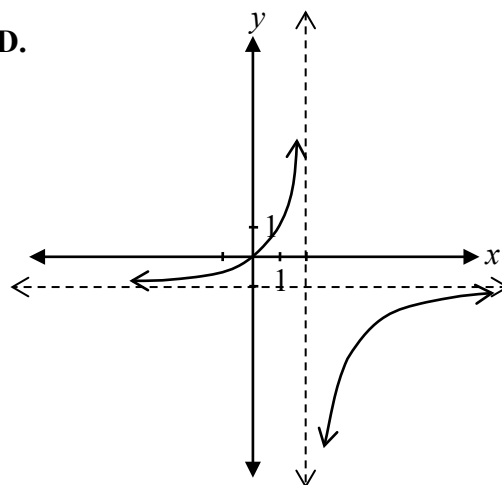
B.



C.



D.



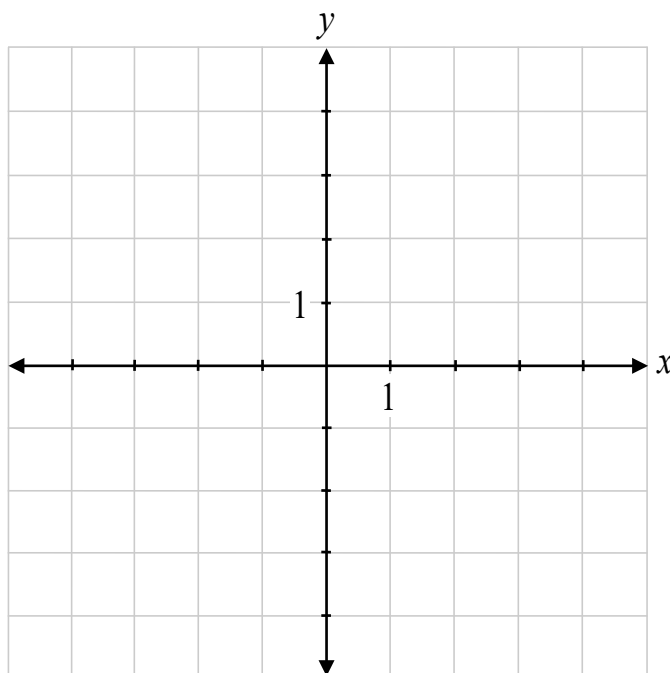
Evaluate.

$$\sin^2\left(\frac{11\pi}{3}\right)\cot\left(\frac{\pi}{4}\right) + \csc\left(\frac{11\pi}{6}\right)$$

Question 28

3 marks 119

Sketch the graph of $y = \log_2[-(x - 2)]$.



Question 29

1 mark 120

Justify that ${}_{12}C_7 = {}_{12}C_5$.

Solve, algebraically.

$$\left(\frac{1}{4}\right)^{3x} = 8^{x-3}$$

Question 31

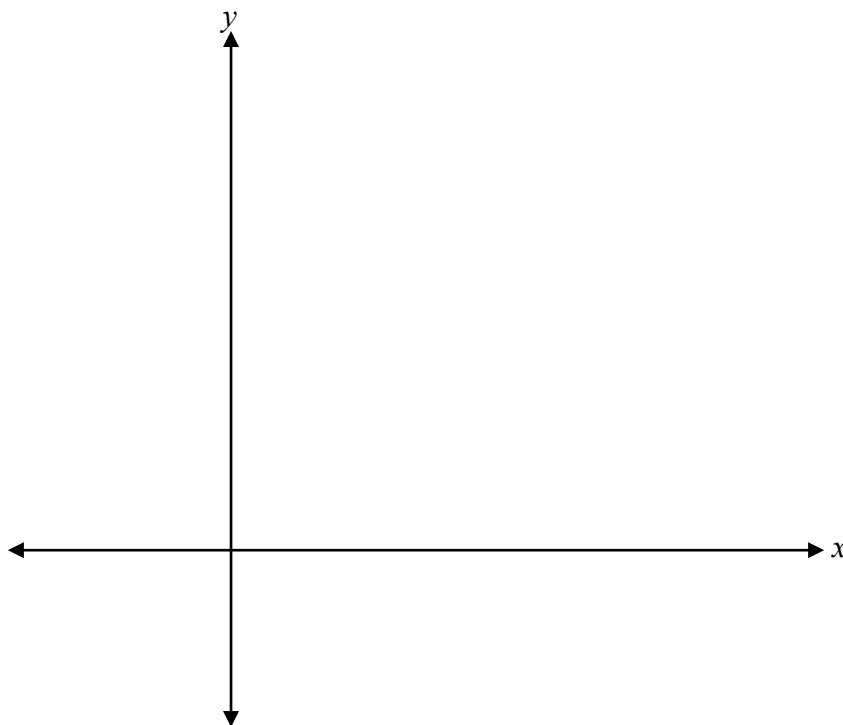
2 marks 122

State the domain and range of the function $y = -\sqrt{x-5} + 4$.

Domain: _____

Range: _____

Sketch at least one period of the graph of $y = 4 \cos \left[3 \left(x + \frac{\pi}{6} \right) \right] + 2$.



Determine, algebraically, the equation of $p(x)$ that satisfies all of the following conditions:

- $p(x)$ is a polynomial function of degree 4
- $p(x)$ has zeros at -5 and 1
- all zeros of $p(x)$ have a multiplicity of 2
- the graph of $p(x)$ has a y -intercept at 75

$p(x) =$ _____

Vitaly was asked to solve the exponential equation $5^{2x+7} = 3 \cdot 7^x$.

Vitaly's work:

$$\begin{aligned}\log(5^{2x+7}) &= \log(3 \cdot 7^x) \\ (2x+7)\log 5 &= \log(21^x) \\ 2x\log 5 + 7\log 5 &= x\log 21 \\ 7\log 5 &= x\log 21 - 2x\log 5 \\ 7\log 5 &= x(\log 21 - 2\log 5) \\ x &= \frac{7\log 5}{\log 21 - 2\log 5}\end{aligned}$$

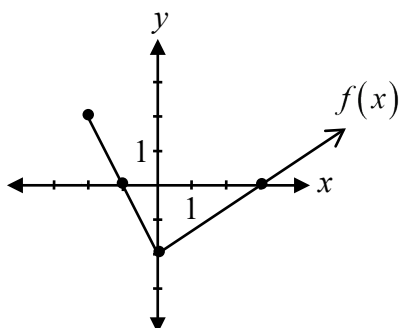
Describe his error.

Question 35

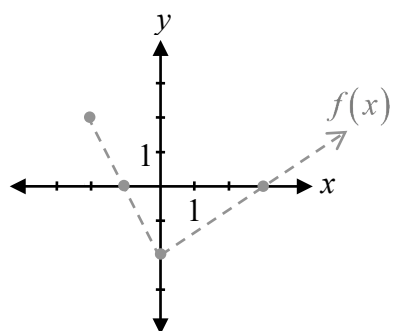
a) 1 mark b) 1 mark c) 1 mark

126
127
128

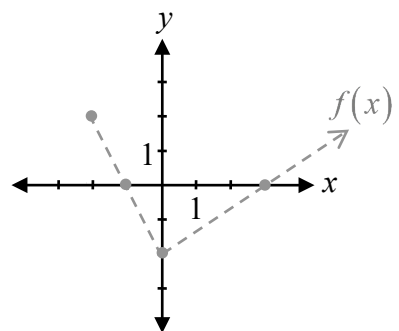
Given the graph of $f(x)$,



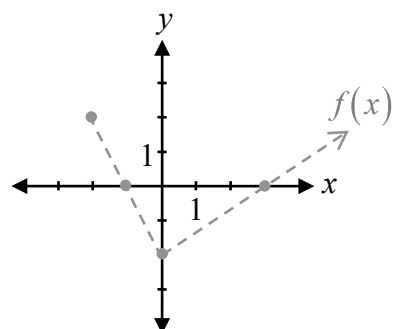
a) sketch the graph of $g(x) = -f(x)$.



b) sketch the graph of $k(x) = |f(x)|$.



c) sketch the graph of $r(x) = f(2x)$.



Determine the exact value of $\sin\left(\frac{17\pi}{12}\right)$.

Question 37

a) 1 mark b) 1 mark

130
131

Given $f(x) = \sqrt{x+3}$ and $g(x) = x-8$,

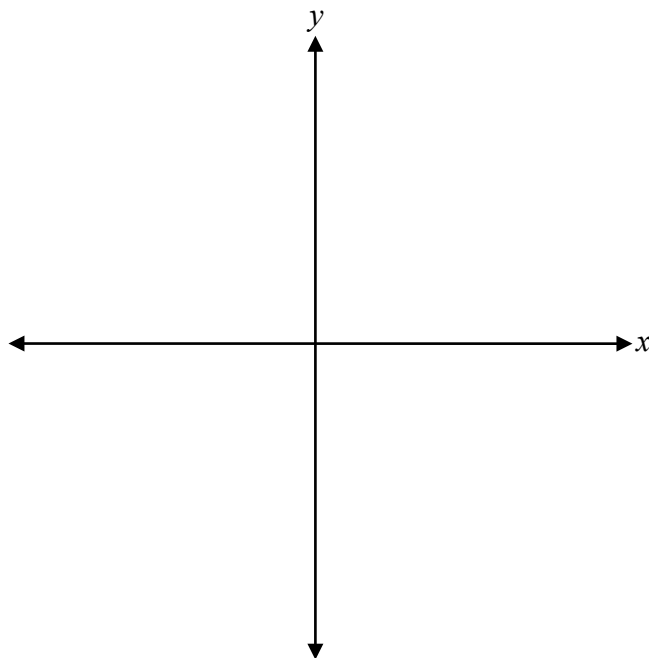
a) determine the value of $g(f(1))$.

b) justify that the value of $(f-g)(-5)$ is undefined.

Solve, algebraically.

$$48\binom{n}{4} = {}_{(n+1)}P_4$$

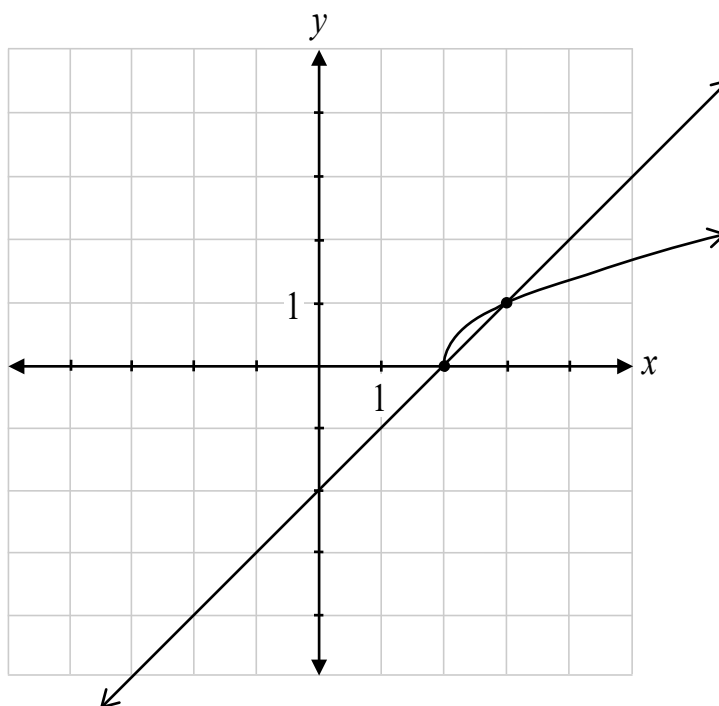
Sketch the graph of $p(x) = (x+1)(x+2)(x-4)$.



Evaluate.

$$\log_5(\log_2 32)$$

Describe how to use the graph to solve the equation $\sqrt{x-2} = x-2$.



Question 42

3 marks 136

Verify, by substitution, that the equation $\frac{\sec \theta}{\tan \theta + \cot \theta} = \sin 2\theta$ is true for $\theta = \frac{\pi}{3}$.

Left-Hand Side	Right-Hand Side

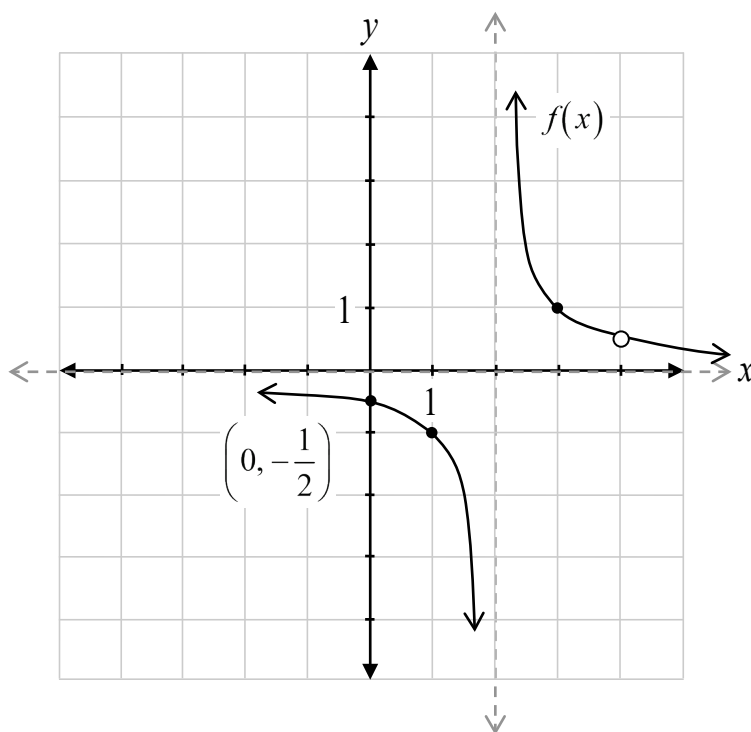
Question 43

1 mark

137

Describe the transformation(s) to the graph of $y = 3^x$ which results in a graph with a y -intercept of -2 .

Determine the equation of the rational function represented by the graph.



$$f(x) = \underline{\hspace{2cm}}$$

Justify that $f(x) = 3x + 2$ and $g(x) = \frac{x-3}{2}$ are not inverses of each other.

The terminal arm of an angle, θ , in standard position passes through the point $(-3, 6)$ and intersects the unit circle at the point $P(\theta)$. Determine the coordinates of the point $P(\theta)$.

Question 47

2 marks 141

Determine the exact value of $2\sin\theta\cos\theta$ if $\theta = \frac{\pi}{12}$.

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

