Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

January 2024

Manitoba

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

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This resource will be available on the Manitoba Education and Early Childhood Learning website at www.edu.gov.mb.ca/k12/assess/archives/index.html.

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While the department is committed to making its publications as accessible as possible, some parts of this document are not fully accessible at this time.

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	-	15	33
Booklet 2	**8**	**24**	**57**
Total	8	39	**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 16 — 1 mark

Identify the range of the function $g(x)=\frac{1}{2}f(x+1)$, given that the range of the function $y=f(x)$ is $[-6,4]$.

a) $[-12,8]$

b) $[-7,3]$

c) $[-5,5]$

d) $[-3,2]$

Question 17 — 1 mark

Identify the value of *a*, given that there are 11 terms in the expansion of $\left(3x^4-y\right)^{2a}$.

a) 5

b) 6

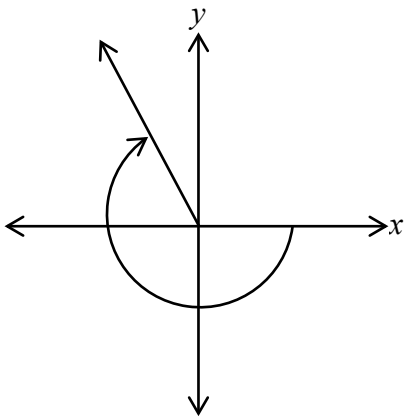
c) 10

d) 11

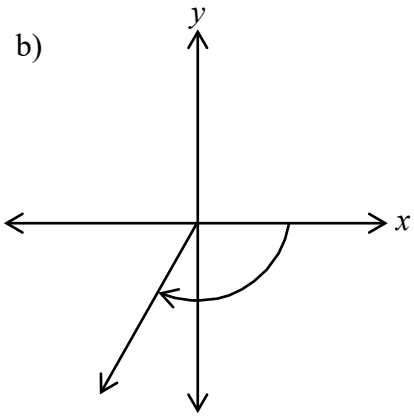
Question 18 — 1 mark

Identify the angle that best represents $\theta = -\frac{6\pi}{5}$.

a)



b)



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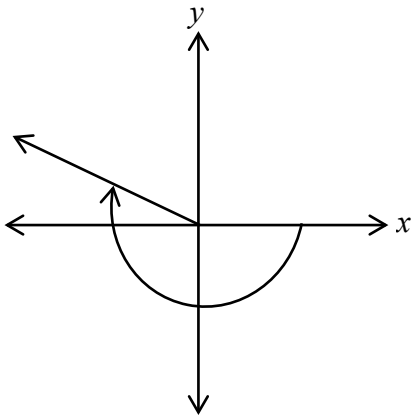

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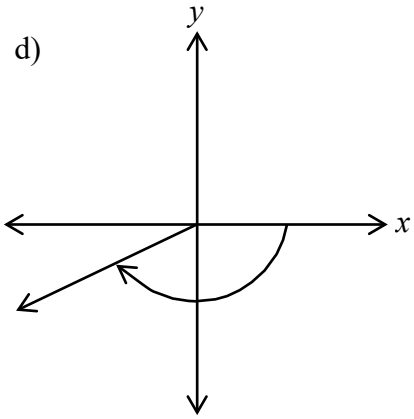


Question 19 — 1 mark

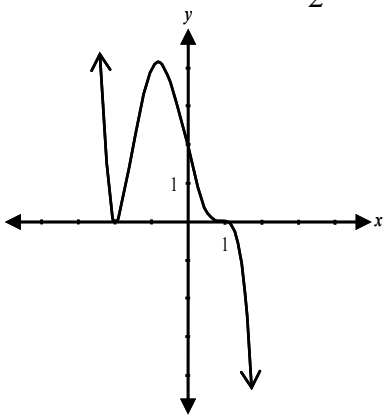
Identify a possible value for *n*, given the graph of $y = -\frac{1}{2}(x+2)^2(x-1)^n$.

a) 1

b) 2

c) 3

d) 4



Question 20 — 1 mark

Identify the statement that is false, given $g(x) = \frac{8x^2}{x^2 - 16}$.

a) the graph of $g(x)$ has one x-intercept.

b) the graph of $g(x)$ has a point of discontinuity (hole) at $x = 0$.

c) the graph of $g(x)$ has two vertical asymptotes.

d) the graph of $g(x)$ has a horizontal asymptote at $y = 8$.

Question 21 — 1 mark

Identify the equivalent form of $\log_a\left(\frac{1}{x^2}\right)$.

a) $-2\log_a x$

b) $1 - 2\log_a x$

c) $2\log_a x$

d) $-2\log_a\left(\frac{1}{x}\right)$

Question 22 — 1 mark

Identify which one of the following expressions is equivalent to ${}_{13}C_6$.

a) ${}_{13}P_6$

b) ${}_{13}C_7$

c) ${}_{12}P_7$

d) ${}_{12}C_6$

Question 23 — 1 mark

Identify the equation of $h(x) = f(x) - g(x)$, given $f(x) = x + 5$ and $g(x) = 4x + 1$.

a) $h(x) = -3x + 6$

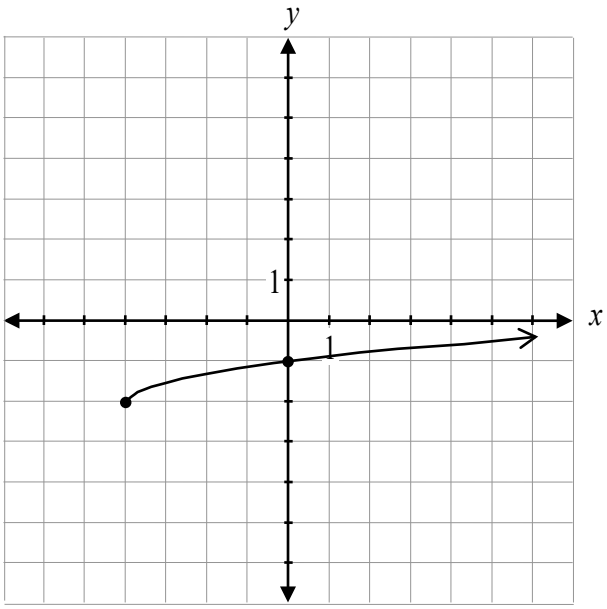
b) $h(x) = -3x + 4$

c) $h(x) = 3x + 6$

d) $h(x) = 3x - 4$

Question 24 — 3 marks — 116

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



$y =$ _____

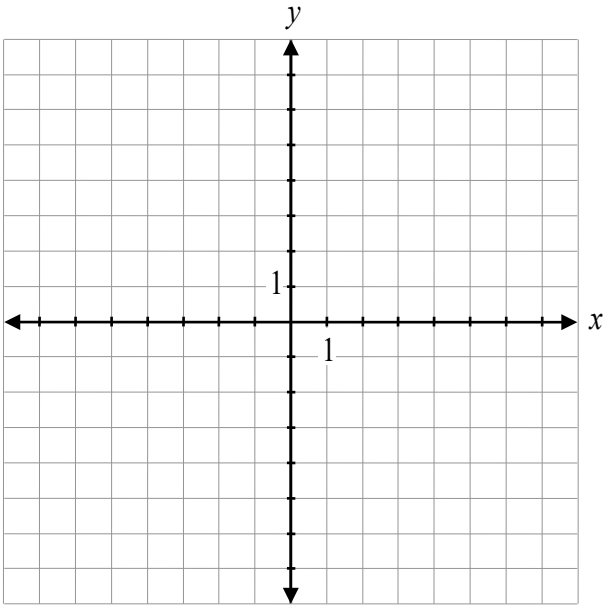
Question 25 — 2 marks — 117

Determine the exact value of x.

$$\sec\left(\frac{2\pi}{3}\right)\left(\sin\left(-\frac{5\pi}{3}\right)\right)(x) = 3$$

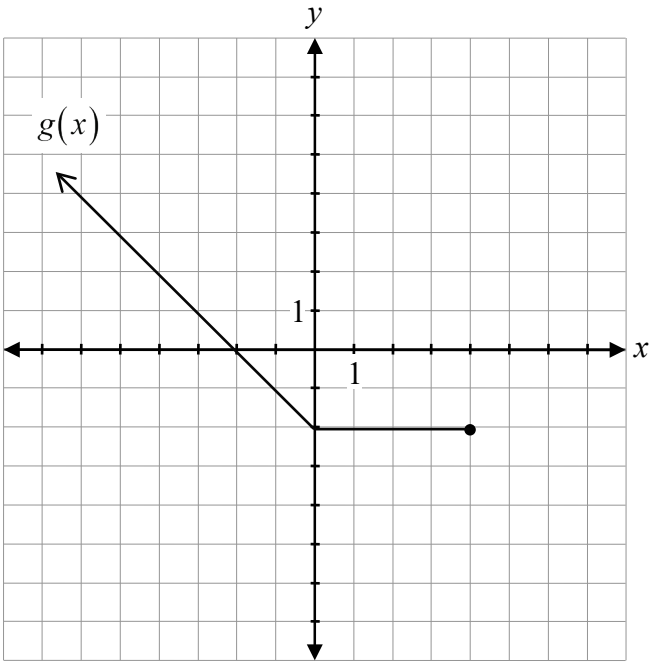
Question 26 — 3 marks — 118

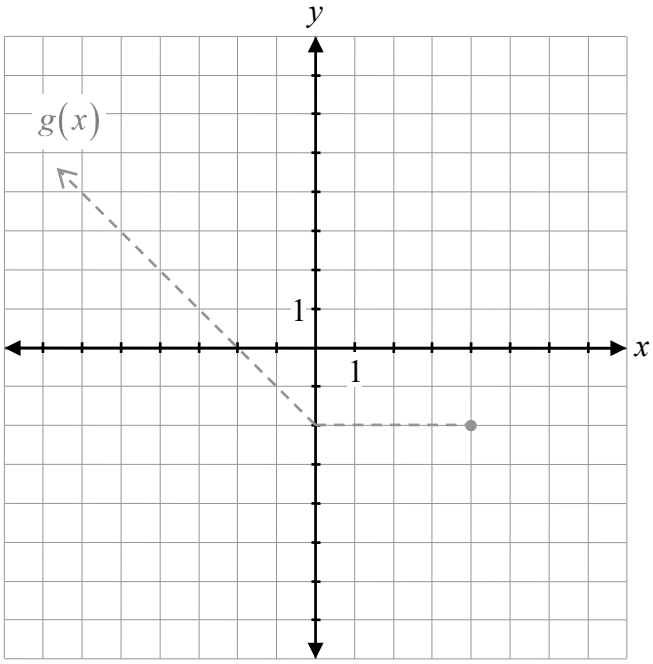
Sketch the graph of $y = 2^{-x} - 3$.



Question 27 — 3 marks — 119

Given the graph of $y = g(x)$, sketch the graph of $y = \dfrac{1}{g(x)}$.





The graph of $g(x)$ has already been drawn for your reference.

No marks will be awarded for the graph of $g(x)$.

Question 28 — 2 marks — 120

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

Question 29 — 1 mark — 121

Explain why the graph of $g(x) = \dfrac{3}{x^2 + 4}$ does not have a vertical asymptote.

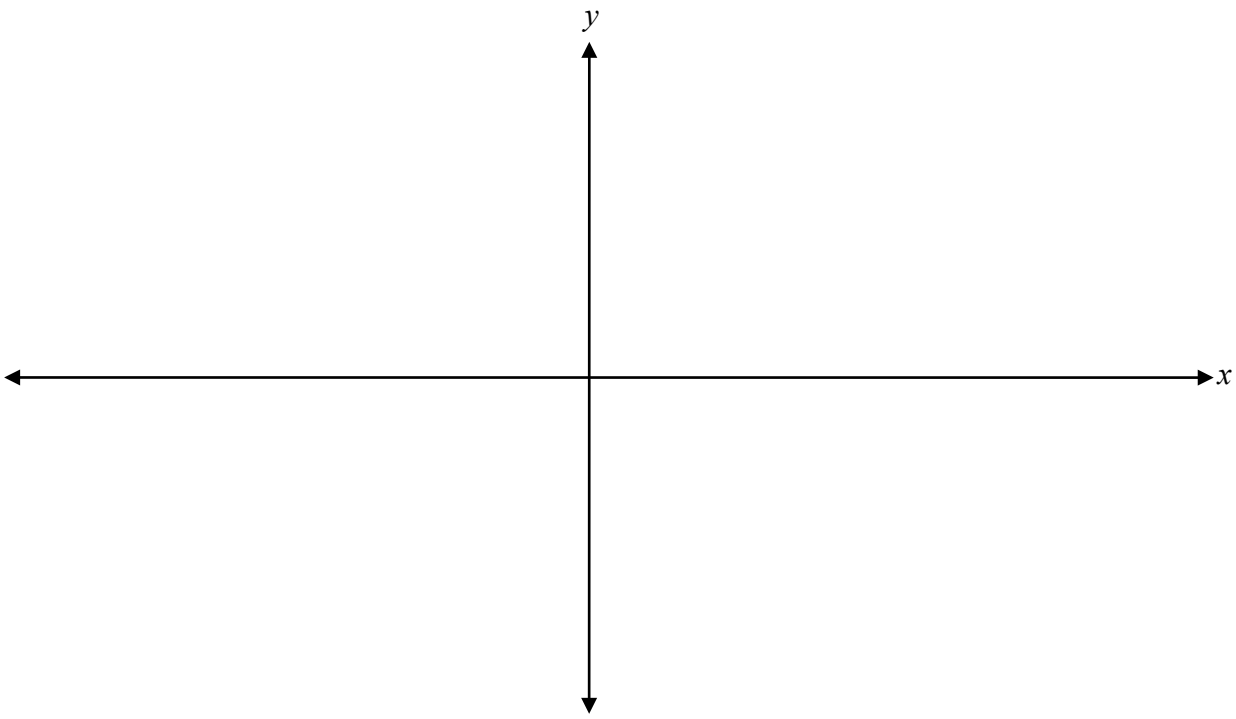
Question 30 — 3 marks — 122

Solve, algebraically.

$$\log_3 x + \log_3 (x+8) = 2$$

Question 31 — 4 marks — 123

Sketch at least one period of the graph of the function $y = \sin\left(3\left(x + 30°\right)\right) - 1$.

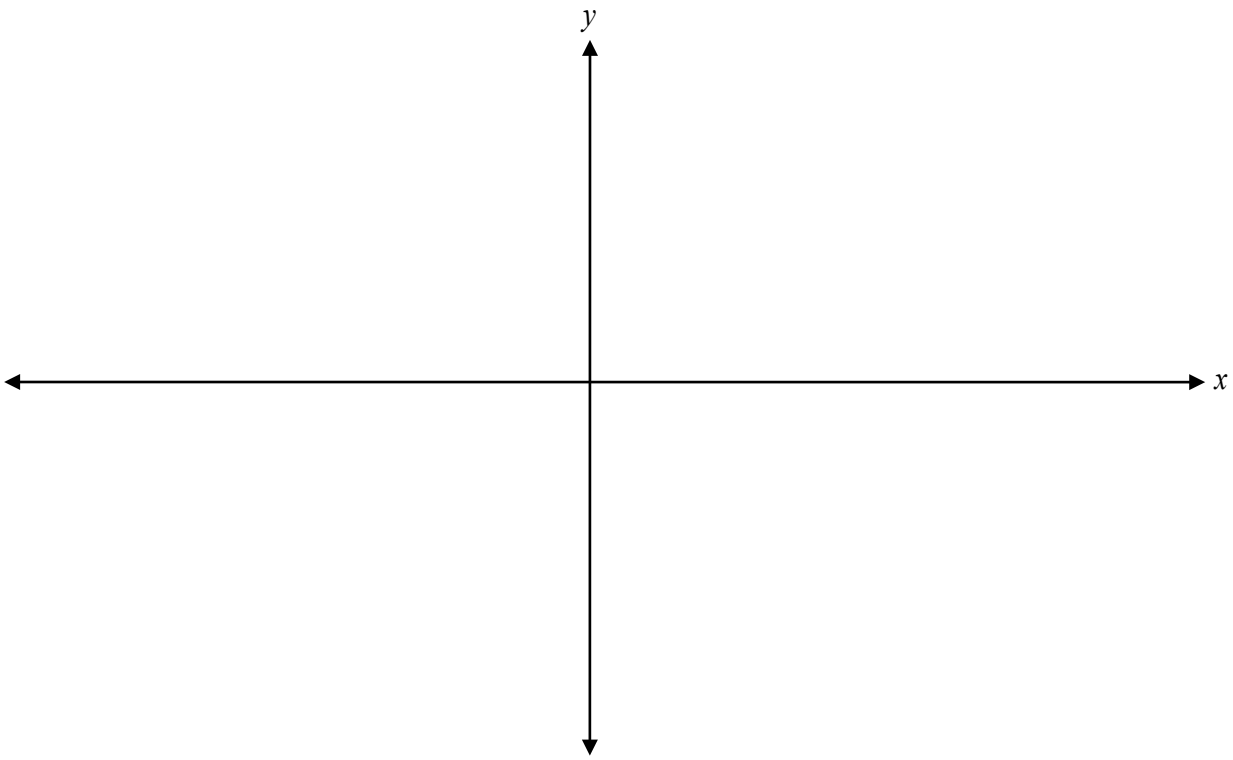


Question 32 — 1 mark — 124

Explain why the domain of the function, $f(x) = \log(x-3)$, is $x > 3$.

Question 33 — 3 marks — 125

Sketch the graph of $p(x) = -(x-3)(x+1)^2(x-5)$.



Question 34 — 2 marks — 126

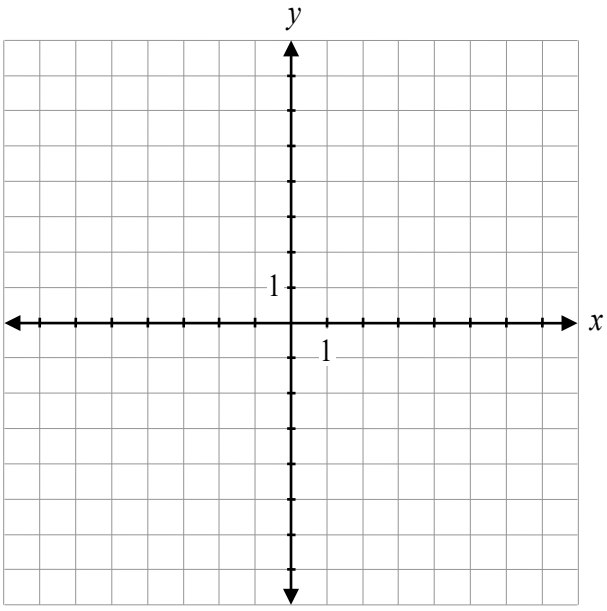
Given that $\sin\theta = -\frac{2}{3}$ and $\tan\theta > 0,$ determine the exact value of $\sin 2\theta.$

Question 35 — 1 mark — 127

Justify whether $\frac{5\pi}{8}$ and $-\frac{11\pi}{4}$ are coterminal angles.

Question 36 — 2 marks — 128

Sketch the graph of $f(x)=\dfrac{-2x(x+1)(x-3)}{2x}$.



Question 37 — 2 marks — 129

Given $\dfrac{\sin\theta + \cos\theta \csc\theta}{\sin\theta}$, determine the non-permissible values of θ, where $\theta \in \mathbb{R}$.

Question 38 — 2 marks — 130

Write an equation of a rational function that has a horizontal asymptote at $y = 0$ and a vertical asymptote at $x = 6$.

Question 39

a) 1 mark b) 2 marks

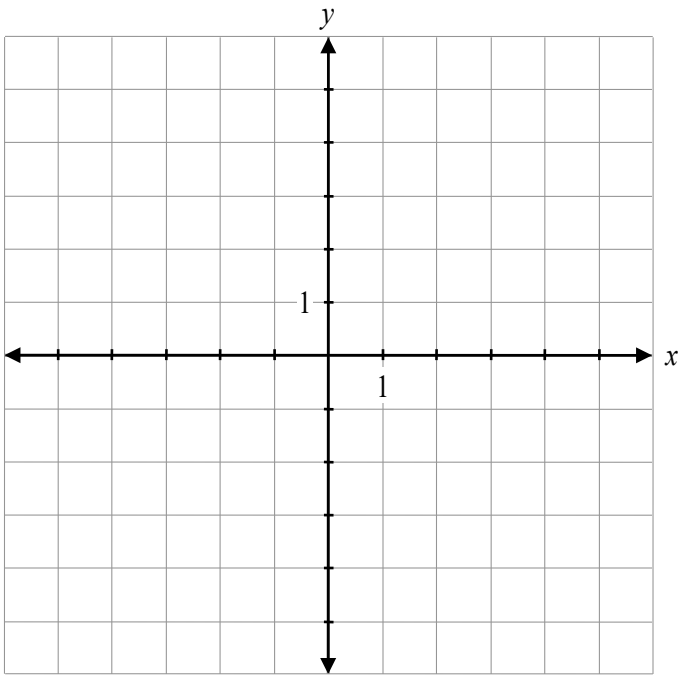
131
132

Given the functions $f(x)=\sqrt{x-1}$ and $g(x)=x^2$,

a) state the equation of $g(f(x))$.

$g(f(x))=$ _____

b) sketch the graph of $g(f(x))$.



Question 40 — 1 mark — 133

Suzanne was asked to determine the value of $\tan\theta$, given that $\sec\theta = -\frac{8}{3}$ and θ terminates in quadrant II.

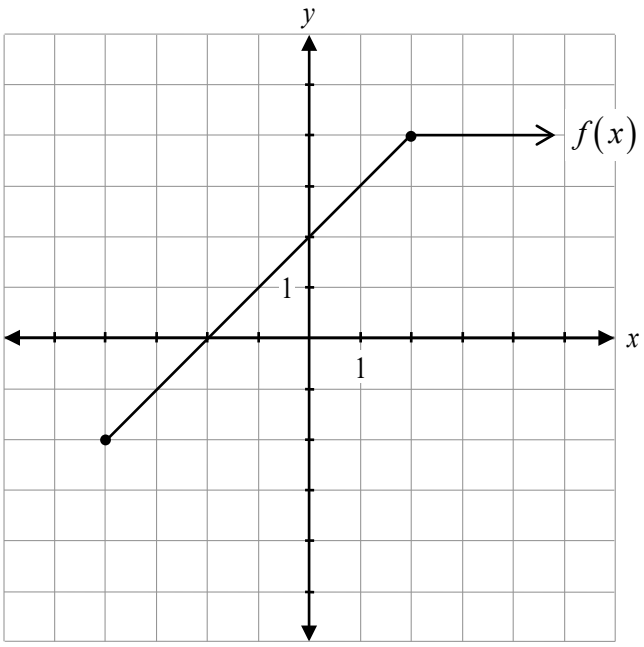
Her solution:

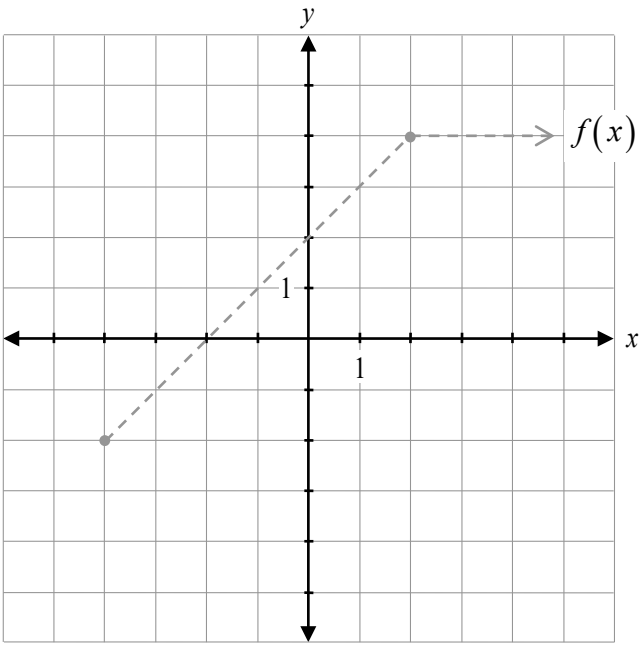
$$(-3)^2 + y^2 = (8)^2$$
$$y^2 = 55$$
$$y = \sqrt{55}$$
$$\tan\theta = \frac{\sqrt{55}}{3}$$

Describe her error.

Question 41 — 2 marks — 134

Given the graph of $y = f(x)$, sketch the graph of $y = \sqrt{f(x)}$.





The graph of $f(x)$ has already been drawn for your reference.

No marks will be awarded for the graph of $f(x)$.

Question 42 — 1 mark — 135

The point $P(\theta) = (0, -1)$ lies on the unit circle. State the angle θ, over the interval $[2\pi, 4\pi]$.

Question 43 — 1 mark — 136

Describe how the transformations of $f(x)$ on the graphs of $g(x) = f(3x - 6)$ and $h(x) = f(3(x - 6))$ are different.

Question 44 — a) 1 mark b) 1 mark (137, 138)

a) Solve.

$$\sqrt{2x+5}-3=0$$

b) Describe how the solution in a) relates to the graph of $y=\sqrt{2x+5}-3$.

Question 45 — 3 marks — 139

Determine all of the zeros of the function $p(x) = x^3 - 2x^2 - 9x + 18$.

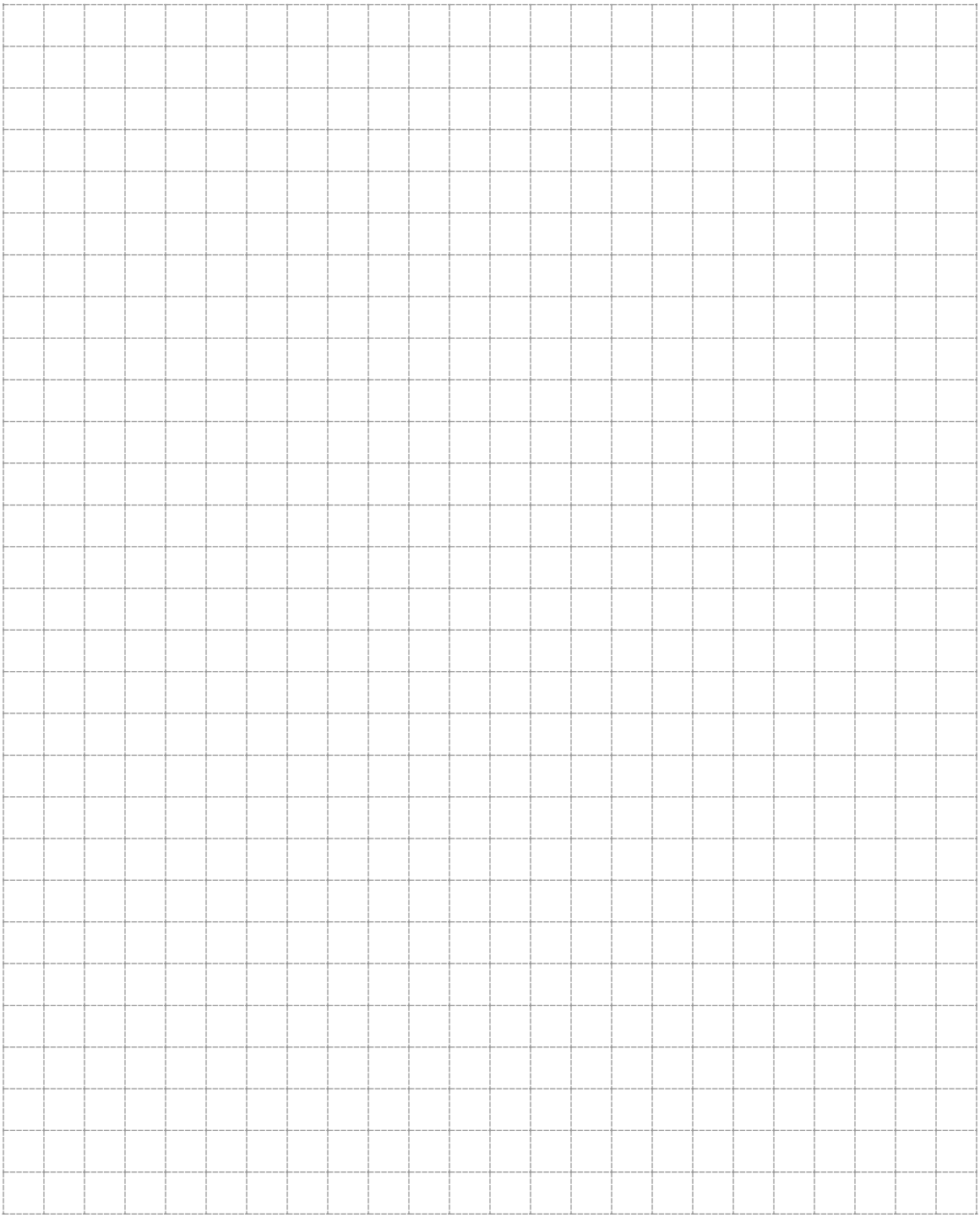
Question 46 — 1 mark — 140

Given that the point $\left(\frac{\sqrt{23}}{6}, y\right)$ is on the unit circle, determine the exact value(s) of y.

Question 47 — 1 mark — 141

State one zero of the function $y = \tan x$.

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



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