Grade 12
Pre-Calculus Mathematics
Achievement Test

Booklet 2

June 2016

Manitoba

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Instructions

Selected Response Questions

- There are 8 questions worth a total of 8 marks.
- 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

- There are 20 questions worth a total of 48 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 15 — 1 mark

Given the polynomial function $P(x) = x^4 - 5x^2 - 2x + 6$, if $P(1) = 0$, identify which statement is true.

a) The y-intercept is 1.

b) $P(x)$ has a factor of $(x + 1)$.

c) The graph has a zero at 1.

d) The graph has a zero at -1.

Question 16 — 1 mark

There are 6 different books that are being distributed evenly amongst three people.

Identify which expression represents the number of possible combinations.

a) ${}_6C_2 \cdot {}_6C_2 \cdot {}_6C_2$

b) ${}_6C_2 \cdot {}_4C_2 \cdot {}_2C_2$

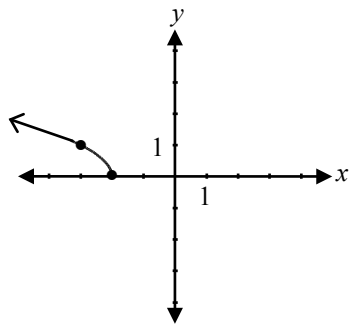
c) ${}_2C_2 \cdot {}_2C_2 \cdot {}_2C_2$

d) $3 \cdot {}_6C_2$

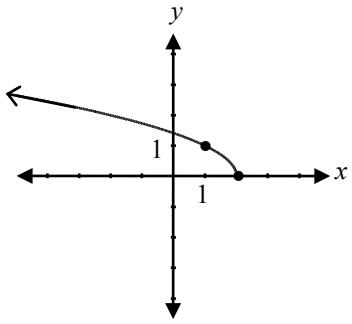
Question 17 — 1 mark

Identify the graph that corresponds to the function $f(x) = -\sqrt{(x-2)}$.

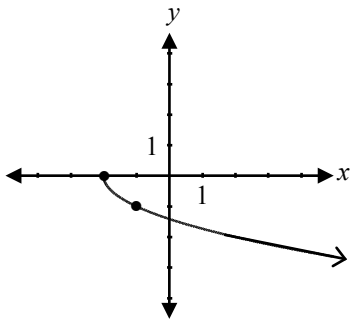
a)



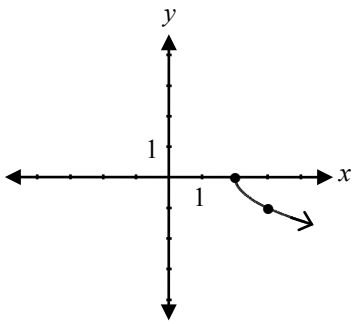
b)



c)



d)



Question 18 — 1 mark

Solve:

$$7^{\log_7 2} = x$$

a) $x = 1$

b) $x = 2$

c) $x = 7$

d) $x = 49$

Question 19 — 1 mark

Identify the equation that has a general solution of $\left.\begin{array}{l}\theta = \frac{\pi}{6} + 2\pi k \\ \theta = \frac{5\pi}{6} + 2\pi k\end{array}\right\}$ where $k \in \mathbb{Z}$.

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

b) $\cos\theta = \frac{1}{2}$

c) $\sin\theta = \frac{\sqrt{3}}{2}$

d) $\cos\theta = \frac{\sqrt{3}}{2}$

Question 20 — 1 mark

Identify the function that has a domain of $x \leq -2$ and a range of $y \geq 3$.

a) $y = \sqrt{x+2} + 3$

b) $y = \sqrt{-(x+2)} + 3$

c) $y = -\sqrt{x-2} - 3$

d) $y = -\sqrt{-(x-2)} - 3$

Question 21 — 1 mark

Given $f(x) = 3x + 2$, identify $f^{-1}(x)$.

a) $f^{-1}(x) = -3x - 2$

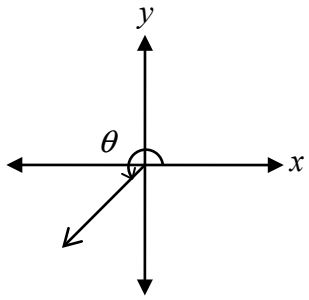
b) $f^{-1}(x) = 2x + 3$

c) $f^{-1}(x) = \frac{x}{3} - 2$

d) $f^{-1}(x) = \frac{x - 2}{3}$

Question 22 — 1 mark

Identify a possible value for the angle θ sketched in standard position.



a) 2

b) 3

c) 4

d) 5

Question 23 — 3 marks — 116

Solve the following equation:

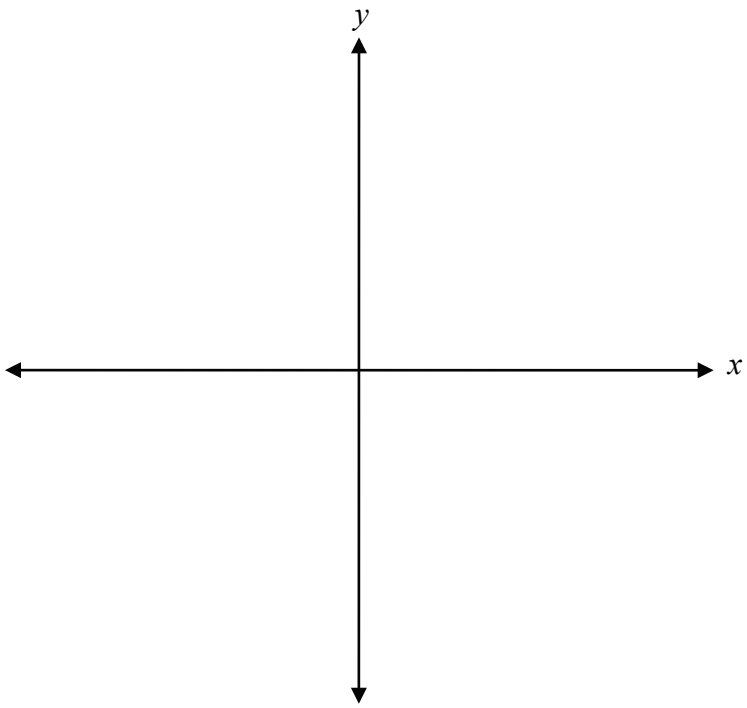
$$\log_3(x+3) + \log_3(x-5) = 2$$

Question 24 — 1 mark — 117

State a coterminal angle for $\theta = \frac{9\pi}{4}$.

Question 25 — 4 marks — 118

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

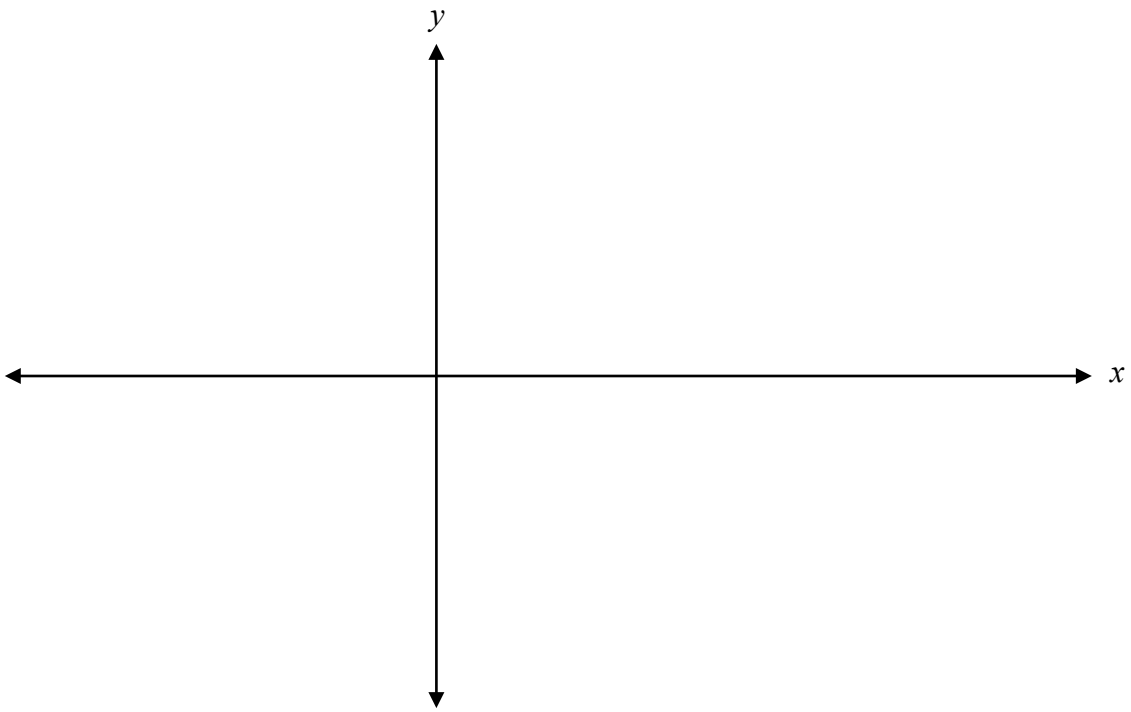


Question 26 — 2 marks — 119

Justify why the binomial expansion of $\left(x + x^3\right)^7$ does not have a term containing x^{10}.

Question 27 — 4 marks — 120

Sketch the graph of $y = -\sin\left(\frac{\pi}{2}(x-1)\right)+3$ over the domain $[0, 6]$.



Question 28 — 2 marks — 121

When $P(x) = 3x^4 - kx^3 + 5x - 14$ is divided by $(x + 2)$, the remainder is -8.

Determine the value of k.

Question 29 — a) 3 marks b) 1 mark

122
123

Given that $\cos\alpha = \frac{7}{12}$ where α is in quadrant IV, and $\sin\beta = \frac{3}{5}$ where β is in quadrant I, determine the exact value of:

a) $\sin(\alpha - \beta)$

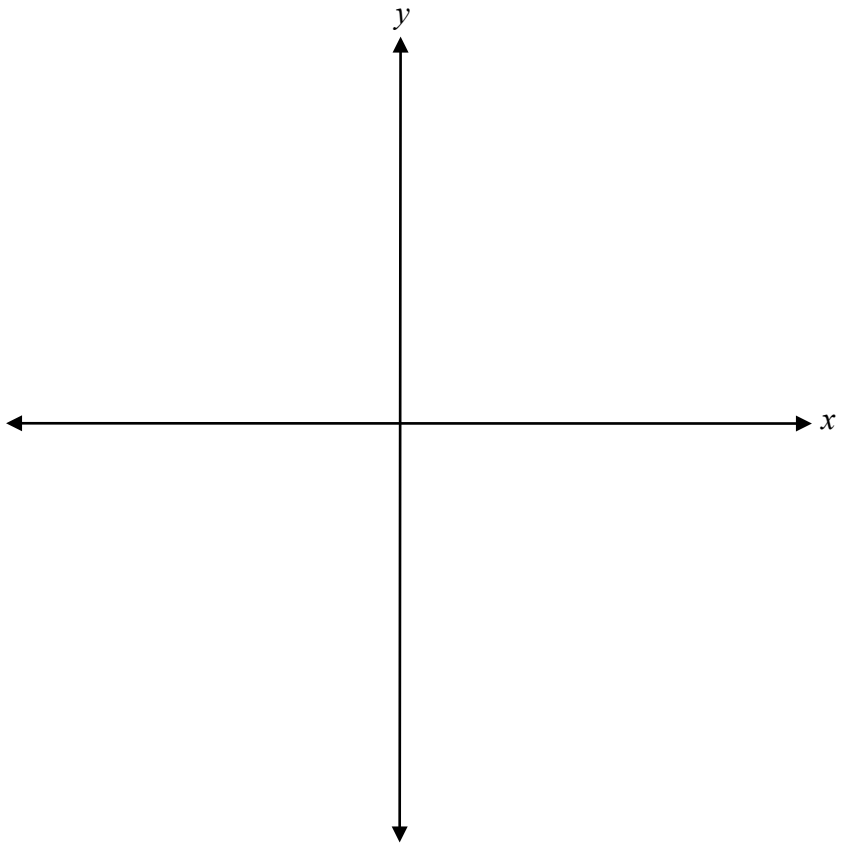
b) $\csc(\alpha - \beta)$

Question 30 — 1 mark — 124

Describe the difference between the graph of $f(x) = \dfrac{7(x+2)}{x+2}$ and the graph of $g(x) = \dfrac{7(x-2)}{x+2}$ at $x = -2$.

Question 31 — 2 marks — 125

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



Question 32 — 3 marks — 126

Solve algebraically:

$${}_nC_3 = n - 2$$

Question 33 — 1 mark — 127

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

$$\sin^2\theta + \sin\theta - 2 = 1$$

$\sin^2\theta + \sin\theta = 3$

$\sin\theta(\sin\theta + 1) = 3$

$\sin\theta = 3$ $\quad$ $\sin\theta + 1 = 3$

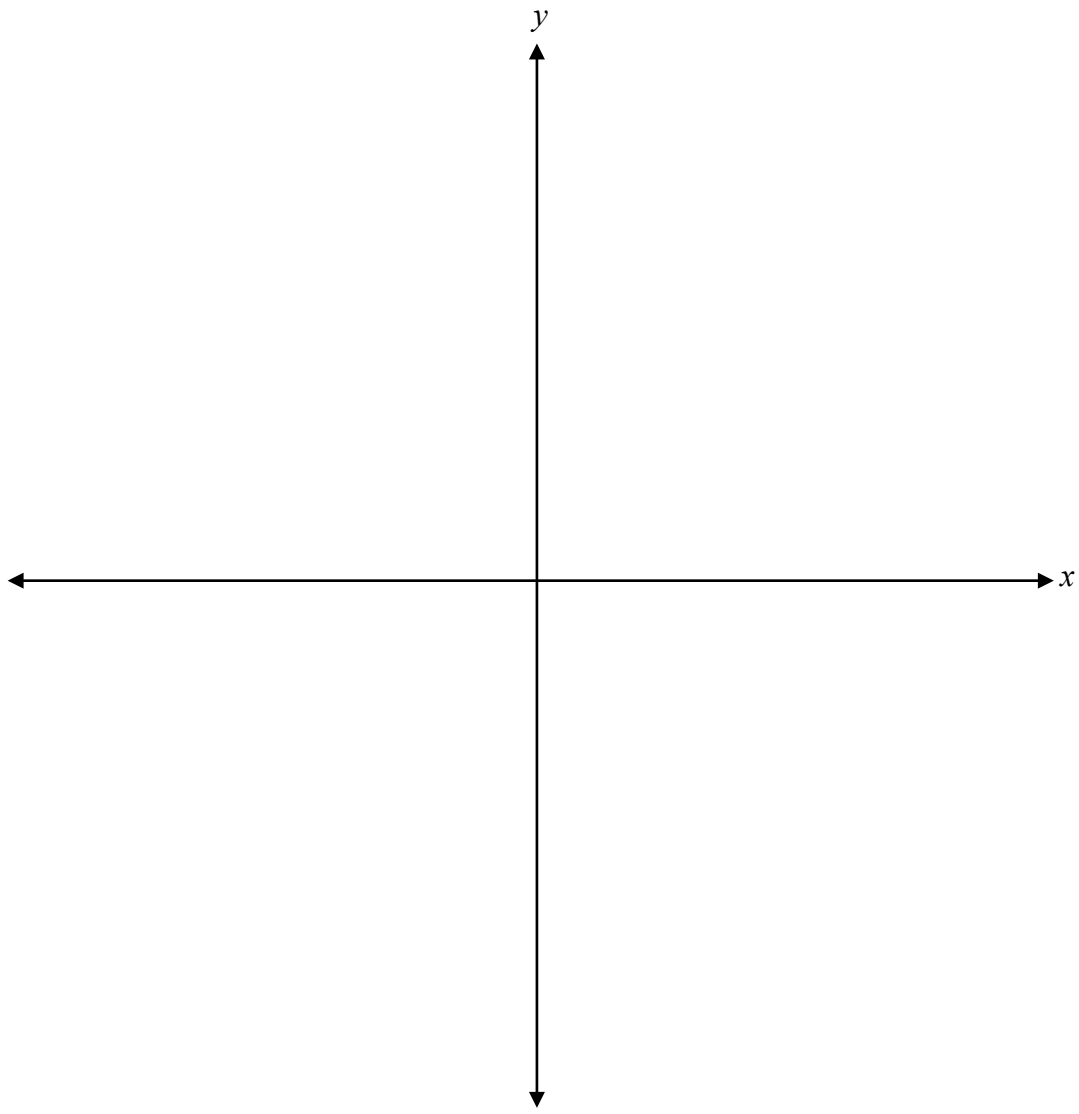
$\sin\theta = 2$

$\therefore$ No solution $\quad$ $\therefore$ No solution

Question 34 — 3 marks — 128

Sketch the graph of the polynomial function with the following characteristics.

- a y-intercept of -9
- zeroes at -1 and 3
- the zero at -1 has a multiplicity of 1 and the zero at 3 has a multiplicity of 2

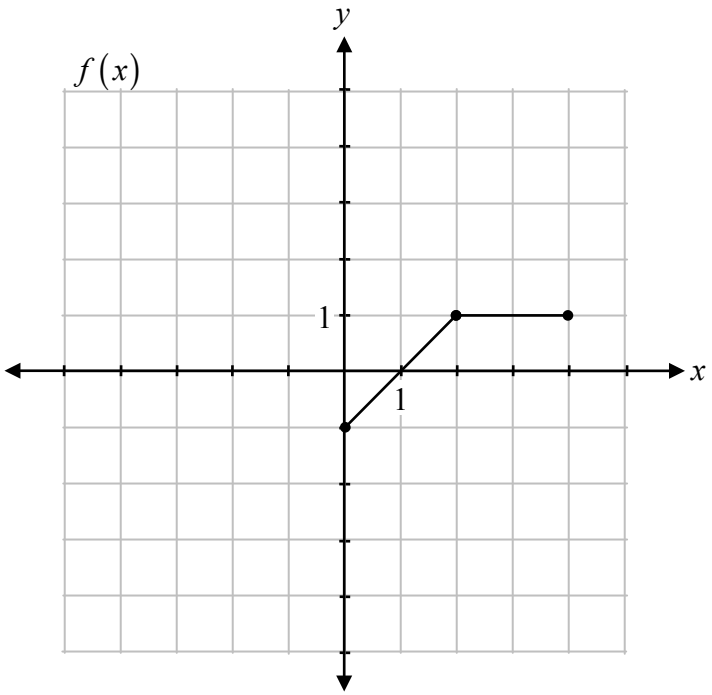


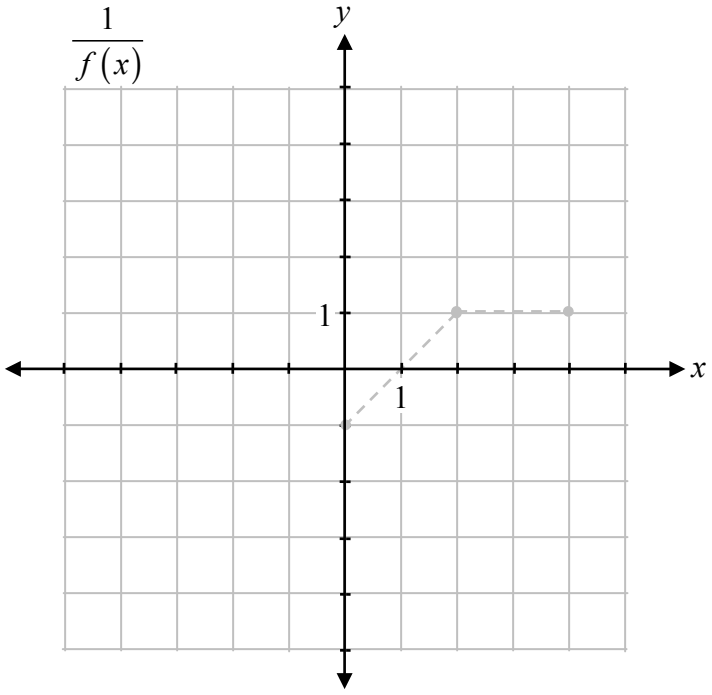
Question 35 — 2 marks — 129

Given $\cot\theta = -\frac{1}{3}$, where θ is in quadrant II, determine the exact value of $\sin\theta$.

Question 36 — 2 marks — 130

Given the function $f(x)$, sketch the graph of the reciprocal, $\frac{1}{f(x)}$.



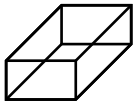


The graph of $f(x)$ has already been drawn for your reference.

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

Question 37 — 3 marks — 131

The volume of a planter, in the shape of a rectangular prism, can be modelled by the polynomial function $V(x) = x^3 + 3x^2 - 34x + 48$.

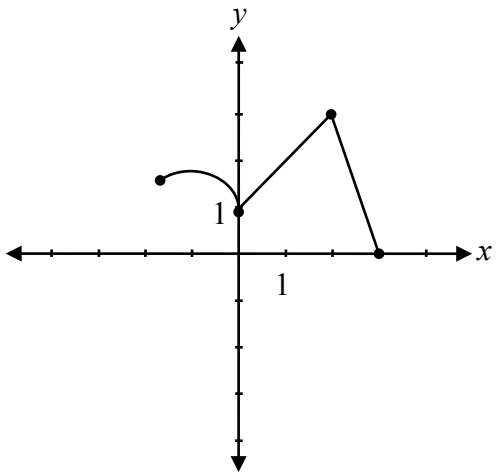


Determine the factors of the function, $V(x)$, which represent possible dimensions of this planter.

$V(x) =$ _____

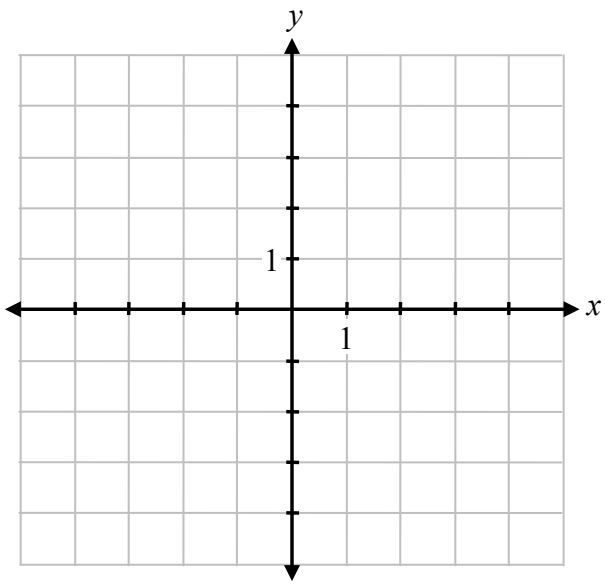
Question 38 — 1 mark — 132

Describe how to determine the range of the inverse of the following graph.



Question 39 — 3 marks — 133

Sketch the graph of the function $y = \sqrt{2x} + 1$.



Question 40 — a) 2 marks b) 1 mark

134
135

Given the following characteristics of a sinusoidal function:

- an amplitude of 2
- a vertical translation down 3 units
- a period of $\frac{\pi}{4}$

a) Determine an equation of this sinusoidal function in the form $y = a\sin b\left(x - c\right) + d$.

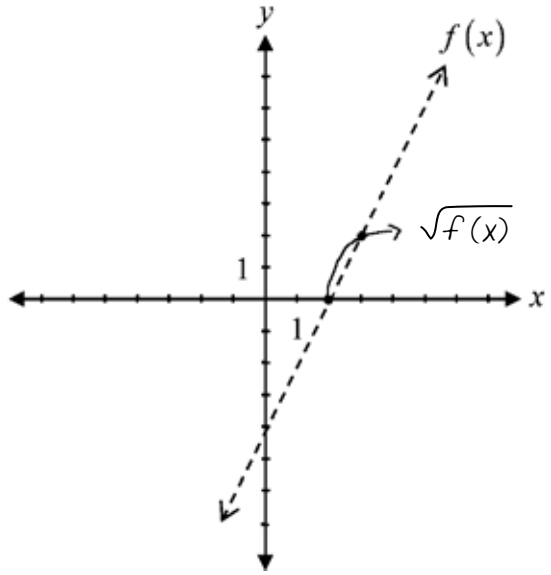
b) Determine the range of this function.

Range:

Question 41 — 1 mark — 136

Suah was given the graph of $f(x)$ and asked to graph $y = \sqrt{f(x)}$.

Her solution is given on the graph below.



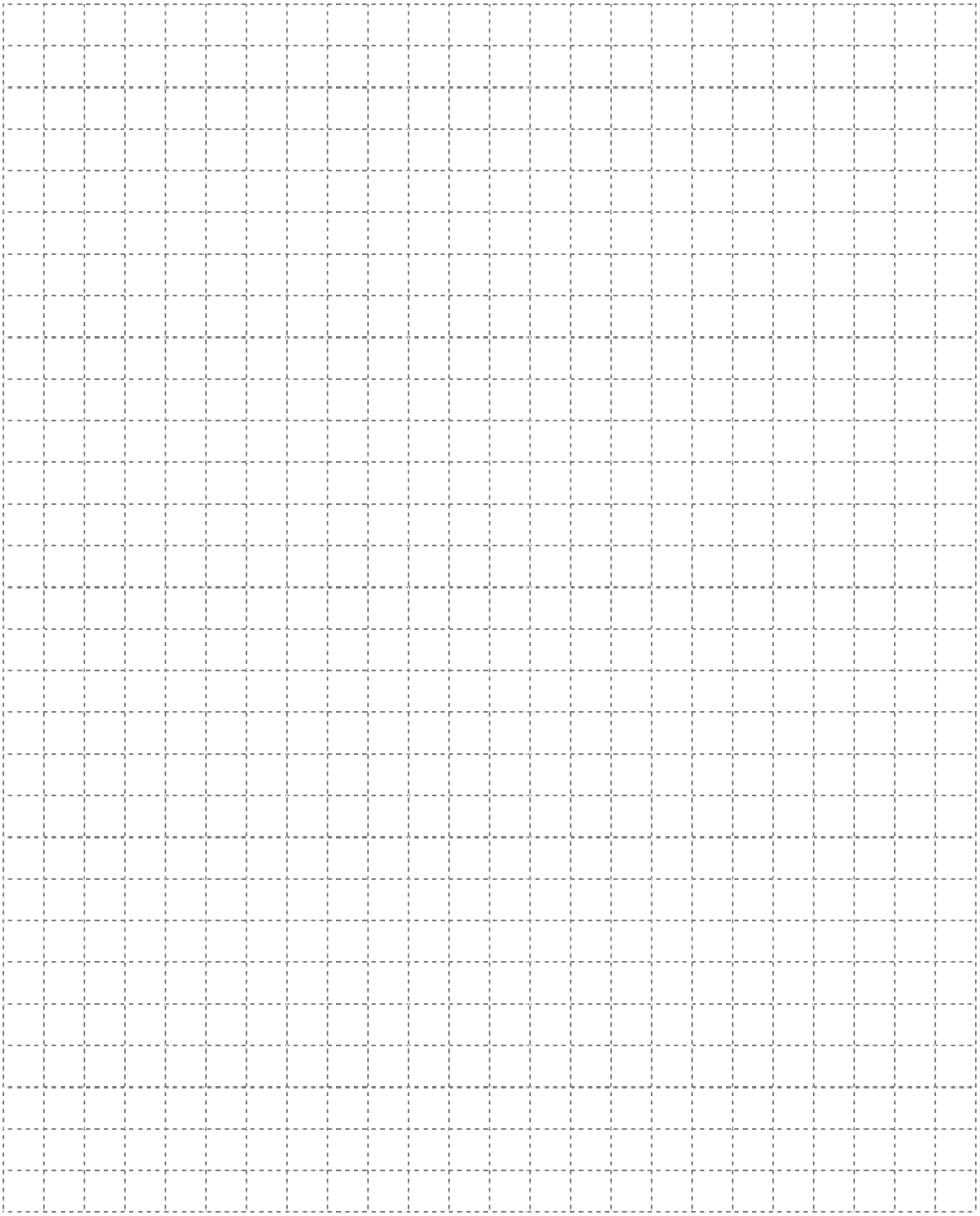
Describe the error Suah made when sketching the graph of $y = \sqrt{f(x)}$.

Question 42 — 3 marks — 137

Solve:

$$9^{2x+1} = 27^{x}$$

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



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