

Chapter 3 Test: Solutions

1. (a) $f(3) = 3^2 + 5$
 $= 14$

(b) original function: $y = x^2 + 5, x \geq 0$

inverse function:

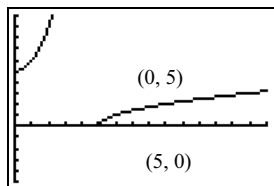
$$x = y^2 + 5, y \geq 0$$

$$x - 5 = y^2, y \geq 0$$

$$y = \sqrt{x - 5}$$

(c) The domain of the inverse is $\{x \mid x \geq 5, x \in \mathbf{R}\}$.

(d) Graph $y = x^2 + 5$ and $y = \sqrt{x - 5}$.



2. (a) Let y represent the total income. Let x represent the number of people attending.

$$y = 8x + 3000$$

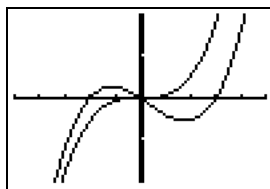
(b) Answers will vary. For example, the event could be cancelled if less than 200 tickets are sold, but the facility can seat a maximum of 600 people, so the domain is $\{x \mid 200 \leq x \leq 600, x \in \mathbf{I}\}$ and the range is

$$\{y \mid 4600 \leq y \leq 7800, y \in \mathbf{I}\}.$$

(c) The inverse function is $y = \frac{x - 3000}{8}$, where x represents the total income and y represents the number of tickets. The domain of the new function is $4600 \leq x \leq 7800$.

3. Several solutions are possible, for example using technology, tables, or an algebraic argument.
Hypothesis: The inverse of a cubic function is also a function.

Using technology, graph several examples of cubic functions, including the examples suggested.

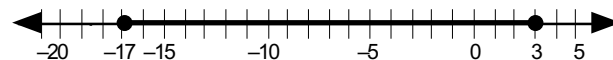


It is possible to draw a horizontal line on the graph of $y = x^3 - x^2 - 6x$ so that it will intersect the curve at several points. Therefore, several points have different x -values but the same y -value. For the inverse, switch the x - and y -values, and several points of the inverse relation will have different y -values for the same x -value. Therefore, the inverse is not a function and the hypothesis is invalid.

4. For a function and its inverse, the following are true.

- The domain of the original function is the range of the inverse.
- The range of the original function is the domain of the inverse.
- The graph of the inverse is a reflection of the original graph in the line $y = x$.
- So that the inverse is a function, you may have to restrict the domain or the range of the original function.
- Interchange the x -values and y -values for each point of the original function to get points of the inverse relation.
- Interchange the x and y variables in the original function and then solve for y . This new equation is the inverse relation.

5. $-3 \leq \frac{x+2}{5} \leq 1, x \in R$

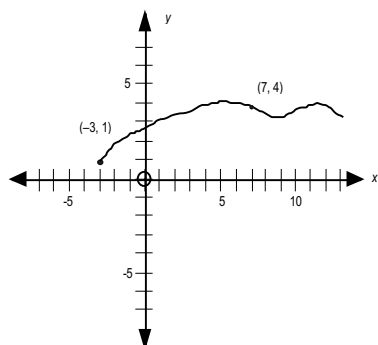


$$-15 \leq x+2 \leq 5$$

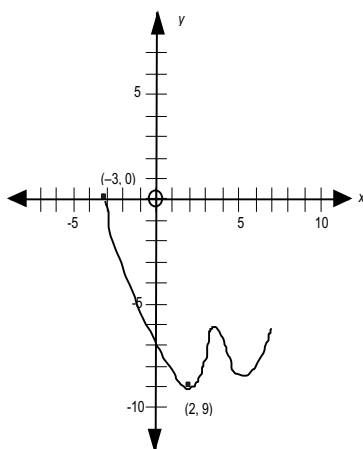
$$-17 \leq x \leq 3$$

6. $y = f(x-3) + 1$

(a) $y = f(x-3) + 1$



(b) $y = -3f(2x)$



(c) $y = f^{-1}(x+2)$

