Name

3-3 Lesson Master

Questions on SPUR Objectives
See Student Edition pages 216–219 for objectives.

SKILLS Objective A

In 1–3, an equation of the form $f(x) = k$ is given. a. Identify the function f and find an equation for its inverse f^{-1}. b. Solve the equation by applying f^{-1} to both sides.

1. $3^x = 2187$
   a. $f(x) = 3^x$; $f^{-1}(x) = \log_3 x$
   b. $x = 7$
2. $\sqrt[5]{x+2} = 1$
   a. $f(x) = \sqrt[5]{x+2}$; $f^{-1}(x) = x^5 - 2$
   b. $x = -1$
3. $x^3 - 6 = 21$
   a. $f(x) = x^3 - 6$; $f^{-1}(x) = \sqrt[3]{x+6}$
   b. $x = 3$

PROPERTIES Objective D

In 4 and 5, equations for two functions are given. Show that the functions are inverses.

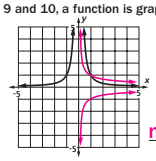
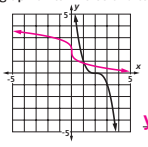
4. $f(x) = 2^x + 1, g(x) = \log_2(x-1)$ $f(g(x)) = f(\log_2(x-1)) = 2^{\log_2(x-1)} + 1 =$ $x - 1 + 1 = x$; $g(f(x)) = g(2^x + 1) = \log_2(2^x + 1 - 1) = x$
5. $p(x) = -4x + 12, q(x) = \frac{-x+12}{4}$ $p(q(x)) = p\left(\frac{-x+12}{4}\right) = -4\left(\frac{-x+12}{4}\right) + 12 =$ $x - 12 + 12 = x$; $q(p(x) = q(-4x + 12) = \frac{-(4x+12)+12}{4} = \frac{4x}{4} = x$
6. Suppose (p, b) is on the graph of the function h. Name a point on the graph of h^{-1}. (b, p)
7. Over what domain is the inverse of the absolute value function also a function?
   Answers vary. Sample: the set of negative real numbers

USES Objective J

8. Suppose a bookstore is having a sale where every fifth book you buy is free. Let p be the function mapping the number of books you buy onto your final cost. Is the inverse of p a function? Explain your answer. No; Answers vary. Sample: Four books and five books cost the same amount, so the inverse maps that cost onto more than one number

REPRESENTATIONS Objective L

In 9 and 10, a function is graphed. Sketch a graph of its inverse and tell if it is a function.

9.  no
10.  yes

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3-4 Lesson Master

Questions on SPUR Objectives
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SKILLS Objective A

1. Fill in the missing steps to solve $\sqrt{2x+5} = 2x + 3$, and tell whether each step is reversible.

Step		Reversible?
? $= (2x+3)^2$	$2x + 5$	no
? $= 4x^2 +$? $+ 9$	$2x + 5, 12x$	yes
$0 =$?	$4x^2 + 10x + 4$	yes
$0 =$ (?)(?)	$2x + 1; 2x + 4$	yes
? or ?	$x = -\frac{1}{2}; x = -2$	yes

Check: $\sqrt{2\left(-\frac{1}{2}\right)+5} = 2\left(-\frac{1}{2}\right) + 3$, so $-\frac{1}{2}$ is a solution.
$\sqrt{2(-2)+5} \neq 2(-2) + 3$, so -2 is not a solution.

In 2 and 3, find all real solutions to the equation.

2. $\frac{1}{2x+4} = \frac{1}{x^2-2x-8}$ $x = 6$
3. $\log_3 x^2 = \log_3(x+2)$ $x = -1$ and $x = 2$

PROPERTIES Objective F

4. *True or False.*
   a. Multiplying both sides of an equation by an expression is always reversible. False
   b. Multiplying both sides of an equation by a constant is always reversible. False (cannot multiply by 0)

USES Objective I

5. The center pole of a tent is placed on a 4-foot tall pedestal and held up by three ropes that run from the top of the pole to points on the ground that are 6 feet from the base of the pole. Each rope is 1.5 times as long as the pole. Find the height of the pole by solving $1.5h = \sqrt{6^2 + (h+4)^2}$ for h.
   $h = 10.4$; 10.4 ft

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Questions on SPUR Objectives
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SKILLS Objective D

In 1–6, find exact solutions to the equation using chunking, factoring, or both.

1. $0 = x^4 + 3x^3 - 4x^2$ $x = 0$ or $x = -4$ or $x = 1$
2. $(2y-4)(y^2-1)(3y^2-y) = 0$ $y = 2$ or $y = 1$ or $y = -1$ or $y = 0$ or $y = \frac{1}{3}$
3. $\sin a + 2 = (\sin a + 2)^2 - 6$ $a = \frac{\pi}{2} + 2\pi k, \forall k \in \mathbb{Z}$
4. $e^{2z} - 4e^{2z} + 4e^z = 0$ $z = \ln 2$
5. $\log_4(p^3) + 5 = (\log_4 p)^2 - 5$ $p = 1024$ or $p = \frac{1}{16}$
6. $2\cos^2 t = -13\sin t - 5$ $t = \frac{7\pi}{6} + 2\pi k$ or $t = -\frac{\pi}{6} + 2\pi k, \forall k \in \mathbb{Z}$

USES Objective I

7. You are running the marathon and currently in second place. The leader is 200 ft from the finish line and running at a constant rate of 14 ft/sec. You are 320 ft from the finish line and running at 13.5 ft/sec, but start accelerating at a rate of 0.5 ft/sec^2.
   a. Write expressions for $\ell(t)$ and $d(t)$, the leader's distance and your distance from the finish line, respectively, after t seconds.
      $\ell(t) = 200 - 14t$; $d(t) = 320 - (13.5t + 0.5t^2)$
   b. Solve the equation $d(t) - \ell(t) = 0$ and explain what the answer means in context.
      $t = -15$ or $t = 16$; We are the same distance from the finish line after 16 seconds.
   c. Did you win the marathon? Explain. No; When $t = 16$, $d(t) = \ell(t) = -24$, so I catch up after we pass the finish line.

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3-6 Lesson Master

Questions on SPUR Objectives
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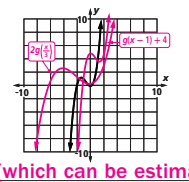
REPRESENTATIONS Objective M

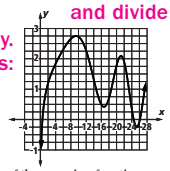
In 1–5, give an equation for the graph of $y = 2x^2 - 3$ under the given transformation.

1. $T_{-1,4}$ $y - 4 = 2(x+1)^2 - 3$
2. $S_{2,3}$ $\frac{y}{3} = 2\left(\frac{x}{2}\right)^2 - 3$
3. $S_{\frac{1}{2},-2}$ $\frac{y-4}{15} = (2(x+1)^2) - 3$
4. $T_{2.5,5}$ $y - 5 = 2(x - 2.5)^2 - 3$
5. $T: (x, y) \to (x - 1, 15y + 4)$

6. At the right is the graph of $y = g(x)$. On the same axes, sketch the graph of
   a. $y = g(x-1) + 4$.
   b. $\frac{y}{2} = g\left(\frac{x}{3}\right)$.



7. Explain how the zeros of the given function can be estimated from the graph of $q(x) = x^4 + 9x + 2$.
   a. p with $p(x) = (x+17)^4 + 9(x+17) + 2$
      subtract 17 from the zeros of q (which can be estimated from the graph)
   b. h with equation $h(x) = 16x^4 + 18x + 2$
      estimate the zeros of q from the graph and divide by 2
   c. $m: x \to (2x+17)^4 + 9(2x+17) + 2$
      estimate the zeros of q from the graph, subtract 17, and divide by 2
8. At the right is the graph of the function f, where $f(x) = \sin(x^2) + \ln(2x) - \frac{1}{8}x$.
   Answers vary. Samples:
   a. Use the graph to estimate three zeros of f.
      0.5, 24.5, and 26
   b. Use your answer to Part a to estimate three zeros of $h: x \to \sin(3x-4)^2 + \ln(2(3x-4)) - \frac{1}{8}(3x-4)$.
      1.5, 9.5, and 10



9. Explain how the graph of $y = 3(x+3)^2$ is related to the graph of the squaring function.
   The graph of $y = 3(x+3)^2$ is the graph of the squaring function shifted three units left and stretched vertically by a factor of 3.
10. Explain how the graph of $\frac{y}{3} = |2x|$ is related to the graph of the absolute value function.
    The graph of $\frac{y}{3} = |2x|$ is the graph of the absolute value function stretched vertically by a factor of 3 and shrunk horizontally by a factor of $\frac{1}{2}$.