Name

3-7 Lesson Master

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

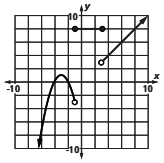
PROPERTIES Objective H

In 1 and 2, let $f(x) = \frac{x-4}{3x-1}$.

1. Tell whether f is continuous on the interval.
   a. [3, 6] yes b. (-2, 1) no c. [-4.5, 0] yes
2. a. Find $f(0)$, $f(2)$, and $f(5)$. $f(0) = 4$; $f(2) = -\frac{2}{5}$; $f(5) = \frac{1}{14}$
   b. From the values in Part a alone, must f have a zero between 0 and 2? Explain.
   No; f is not continuous on this interval.
   c. From the values in Part a alone, must f have a zero between 2 and 5? Explain.
   Yes, by the Intermediate Value Theorem.
3. Explain why the function $s: z \rightarrow e^{2z} - \sin^2(z+1)$ is continuous over the real numbers.
   Exponential and trigonometric functions are continuous over the real numbers, and the difference of two continuous functions is a continuous function.
4. Use the Intermediate Value Theorem to show that the function f where $f(x) = 4x^2 - 2^x$ has a zero between 0 and 1.
   $f(0) = -1 < 0$ and $f(1) = 2 > 0$. Since f is continuous on [0, 1], f has a zero on this interval.
5. a. On January 11, 2009, the high temperature in Chicago, IL was 38°F and the low temperature was 16°F. At some point on that day, was the temperature 22°F? Explain.
   Yes; temperature change is continuous over time.
   b. On July 1, 2001, the cost of a U.S. postage stamp was 34¢. By May 14, 2007, the price had risen to 41¢. At some point between those dates, must the cost of stamps have been 36¢? Explain.
   No; the cost of postage stamps is not continuous over time.

REPRESENTATIONS Objective M

In 6 and 7, refer to the graph of the function k at the right.



6. Tell whether k is continuous over the interval.
   a. [0, 2] yes b. [-2, 4] no
   c. (1, 6) no d. (-3, -2) yes
7. Name two pairs of consecutive integers between which k has a zero.
   -4 and -3, -3 and -2

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3-8 Lesson Master

Questions on SPUR Objectives
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SKILLS Objective E

1. Solve $-2z - 1 \geq 15$ and justify each step.

Step	Justification
$-2z - 1 \geq 15$	Given
$-2z \geq 16$	Addition Property of Inequality
$z \leq -8$	Multiplication Property of Inequality (Part 2)

In 2–5, solve the inequality.

2. $2^x \leq 9$ $x \leq \log_2 9$
3. $\log_4 y < 3$ $y < 64$
4. $\ln w > 0.5$ $w > \sqrt{e}$
5. $\left(\frac{1}{2}\right)^p \leq 7$ $p \geq \log_{\frac{1}{2}} 7$

PROPERTIES Objectives F and G

6. Give a counterexample to show that this statement is false. Then change it to make it true. If f is a 1-1 function, applying f to both sides of an inequality always preserves the sense of the inequality.
   Answers vary. Sample $f(x) = e^{-x}$; If f is an increasing function, applying f to both sides of an inequality always preserves the sense of the inequality.
7. *True or False.*
   a. If a function is increasing, then its inverse is a function. True
   b. If a function is increasing, then its inverse is increasing. True
   c. If a function is decreasing, then its inverse is increasing. False

USES Objective I

8. In an effort to clean up the environment, biotechnologists sometimes inoculate plant roots with engineered bacteria that enable the plants to remove toxic and noxious organic compounds from the air. Suppose that a biotechnologist starts with 50 engineered bacteria, and needs at least 10,000 such bacteria to inoculate her plants. If the bacteria population P after t hours can be modeled by $P = 50 \cdot 2.2^t$, write an inequality to represent the situation and solve it to find the range of acceptable incubation times she can wait to harvest the bacteria and inoculate the plants.
   $10{,}000 \leq 50 \cdot 2.2^t$; $t \geq 6.7$; The incubation time must be at least 6.7 hours, or 6 hours 42 minutes.

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Questions on SPUR Objectives
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SKILLS Objective E

In 1–3, solve the inequalities algebraically.

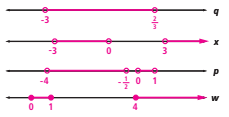
1. $(2y-3)(3y+4) < 0$ $-\frac{4}{3} < y < \frac{3}{2}$
2. $3x^2 + x + 2 > 12x + 6$ $x < -\frac{1}{3}$ or $x > 4$
3. a. $6^{2p+1} \geq 6^{9p}$ $p \leq \frac{1}{7}$ b. $6^{2p+1} > 6^{9p}$ $p < \frac{1}{7}$ c. $6^{2p+1} < 6^{9p}$ $p > \frac{1}{7}$

In 4–7, solve the inequalities by using the Test-Point Method.

4. $2z^2 \ln(z+3) < 4z \ln(z+3)$ $-3 < z < -2$ or $0 < z < 2$
5. $(2n+3)(n-7)(8n+5) \geq 0$ $-\frac{3}{2} < n < -\frac{5}{8}$ or $n \geq 7$
6. $\frac{t+2}{(t-1)(3t-1)} > 0$ $-2 < t < \frac{1}{3}$ or $t < 1$
7. $\frac{x^2-4}{x(x-6)} < 0$ $-2 < x < 0$ or $2 < x < 6$

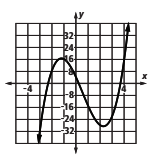
In 8–11, solve the inequality and graph the solution set on the number line provided.

8. $4q^2 - 6 < -2q^2 - 14q + 6$ $-3 < q < \frac{1}{3}$
9. $3^{2x^2+x} > 3^{x^2+10x}$ $-3 < x < 0$ or $x > 3$
10. $\frac{2p^2+p}{(p-1)(p+4)} < 0$ $-4 < p < -\frac{1}{2}$ or $0 < p < 1$
11. $w^2 \log w \geq 16 \log w$ $0 \leq w \leq 1$ or $w \geq 4$

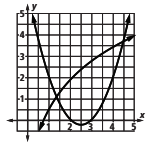


REPRESENTATIONS Objective M

12. A graph of the function g is shown at the right. Use it to estimate the solutions to



   a. $g(x) > 0$ for $-4 \leq x \leq 4$.
   $-2.4 < x < 0.25$ or $x > 3$
   b. $g(x) \geq 0$ for $0 \leq x \leq 3$.
   $0 \leq x \leq 0.25$
13. At the right are graphs of $f(x) = \ln(2x^2)$ and $g(x) = x^2 - 5x + 6$. Use the graph to estimate the solutions to



   a. $\ln(2x^2) > x^2 - 5x + 6$.
   $1.3 < x < 4.5$
   b. $x^2 - 5x + 6 > \ln(2x^2)$
   $x < 1.3$ or $x > 4.5$

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3-10 Lesson Master

Questions on SPUR Objectives
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SKILLS Objectives A and B

In 1–4, find all real solutions to the equation.

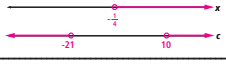
1. $|a+12| = 4$ $a = -8$ or $a = -16$
2. $|7b+36| = 1$ $b = -5$ or $a = -\frac{37}{7}$
3. $3|m-4| = 6 - 9m$ $m = -1$
4. $|2.5p - 17| = -12$ no solutions

In 5–8, find all real solutions to the inequality.

5. $|w+9| < 10$ $-19 < w < 1$
6. $|6r^2 + r| < 0$ no solutions
7. $\left|\frac{3}{4}n + 6\right| > 2n + 3$ $n < \frac{12}{5}$
8. $|2y^2 - 7| > 25$ $y > 4$ or $y < -4$

In 9 and 10, solve the inequality and graph the solutions on the number line provided.

9. $2|x-7| < 6x + 16$ $x > -\frac{1}{4}$
10. $31 < |2c + 11|$ $c > 10$ or $c < -21$



USES Objectives I and K

11. In the sport of tenpin bowling, there are specifications for the ball, pins, and lane.
    a. The ball must be 26.853 inches in circumference, with a tolerance of 0.149 inches. What are the maximum and minimum possible circumferences for a bowling ball?
    26.704 inches and 27.002 inches
    b. Each pin must weigh 3 pounds 8 ounces, with a tolerance of 3 ounces. Describe the maximum and minimum possible weights w with an absolute value equation.
    $|w - 3.5| = \frac{3}{16}$
12. At the right is a tolerance chart that one company uses for acceptable lengths of PVC heat shrinkable tubing. Describe the range of acceptable lengths ℓ each tube with an absolute value inequality.
    a. 4.5-inch tube $4.32'' \leq \ell \leq 4.68''$
    b. 79-inch tube $77.25'' \leq \ell \leq 80.75''$

Length	Tolerance	Length	Tolerance
$\frac{1}{4}''$ to under 4″	±0.063″	28″ to under 36″	±0.750″
2″ to under 4″	±0.125″	36″ to under 60″	±1.250″
4″ to under 6″	±0.180″	60″ to under 75″	±1.500″
6″ to under 12″	±0.250″	75″ to under 80″	±1.750″
12″ to under 18″	±0.450″	80″ to under 100″	±2.000″
18″ to under 28″	±0.625″		