RLP-ALG2B · RLP Algebra 2B — Logarithms, Transformations, Trigonometry and Statistical Inference

Unit 2: Transformations of Functions

Practice Workbook. The same problems, in the same order, as the Practice sections of the online lessons.

Name _____ Period _____

Lesson 2.1 — Translations, Reflections and Symmetry

FLUENCY

1. Complete the square to write $y = x^2 + 4x - 3$ in vertex form, and give the vertex.

2. Complete the square to write $y = x^2 - 8x + 18$ in vertex form, and give the vertex.

3. Complete the square to write $y = x^2 - 12x + 42$ in vertex form, and give the vertex.

4. Describe $g(x) = (x + 5)^2 - 3$ as a transformation of $f(x) = x^2$, and give the vertex.

5. Describe $g(x) = -\sqrt{x} + 2$ as a transformation of $f(x) = \sqrt{x}$.

6. Describe $g(x) = 2^{x-1} + 4$ as a transformation of 2^x, and give its horizontal asymptote.

7. Classify each as even, odd or neither: $x^4 - 2x^2$; $x^3 - 5x$; $x^2 + x$.

8. The graph of g is $y = |x|$ moved so its vertex is at (2, 3). Write $g(x)$.

APPLICATION

9. A St. Louis July afternoon reached 38°C (illustrative). Using $F = 1.8C + 32$, convert it, and describe the conversion as transformations of a temperature graph.

10. A bakery's daily profit is $p(d)$ dollars on day d. Write the function for each change: every day earns $40 more; the whole schedule starts 3 days later; profits double.

11. The point (4, 2) is on the graph of $f(x) = \sqrt{x}$. Where does it move under $f(x + 4) - 1$, and under $-f(x)$?

CHALLENGE

12. Prove that the product of two odd functions is even.

REVIEW

13. Solve for x: $5^x = 3.5$. Give an exact answer using logarithms and a decimal to the nearest thousandth.

14. Evaluate: $\log_{10} \sqrt{10}$

Lesson 2.2 — Stretches, Absolute Value and Piecewise Functions Lab

FLUENCY

1. For $y = 3|x + 2| - 6$, give the vertex, the slopes of the two rays and the intercepts.

2. If $(6, 5)$ is on the graph of f, which point must be on $y = f(2x)$, and which on $y = 3f(x)$?

3. Graph $y = -\frac{1}{2}|x - 4| + 1$: vertex, direction and x-intercepts.

4. Find the x-intercepts of $y = 2|x - 1| - 3$.

5. Write $y = |2x - 6|$ as a piecewise function.

6. A garage (illustrative) charges \$3 for the first hour or less, \$2 for each additional hour or part, maximum \$15. Find the cost for 1 hour, 1.25 hours, 4.5 hours and 9 hours.

APPLICATION

7. Garage B (illustrative) charges a flat \$2.50 per started hour with no maximum. For which lengths of stay, up to 8 hours, is it cheaper than garage A above?

8. A tax (illustrative) is 0 on income up to \$10,000 and 10% of the amount above it. Show it equals $0.05(x - 10{,}000) + 0.05|x - 10{,}000|$ and evaluate at \$8,000 and \$30,000.

9. Compare $f(x) = |x| + 1$ with g given by the table $(-2, 5)$, $(0, 1)$, $(2, 5)$. Which grows faster away from 0, and what is g's likely rule?

CHALLENGE

10. Find k if the graph of $y = f(kx)$ passes through $(2, 7)$, given that $f(8) = 7$ and f takes the value 7 nowhere else.

REVIEW

11. Expand: $\log(x^5y \,/\, z^3)$

12. A quantity starts at 1,200 and decreases by 2% each year. Write a model and find its value after 13 years, to the nearest whole number.

Lesson 2.3 — Absolute Value Equations, Inequalities and Tolerance

FLUENCY

1. Solve: $|x - 7| = 3$

2. Solve: $|x - 3| = 1$

3. Solve: $|x + 3| = -9$

4. Solve: $|x + 6| = 9$

5. Solve and graph: $|x - 8| < 4$

6. Solve and graph: $|x - 1| \geq 2$

7. Solve and graph: $|x - 6| \geq 6$

8. Solve and graph: $|x + 7| < 5$

9. Solve $3|x + 1| - 4 = 11$.

10. Solve $|3x + 1| > 8$ and describe the graph.

APPLICATION

11. A bolt must be 12.00 ± 0.05 mm. Write the acceptable lengths as an absolute value inequality and solve it.

12. A Kansas City office thermostat keeps a room within 3°F of 70°F. Write and solve the inequality, and say what temperatures trigger the heater or air conditioner.

13. A cereal box should hold 510 g, and boxes more than 8 g away from that are rejected. Write the rejection condition and solve it.

CHALLENGE

14. Solve $|x - 4| \geq 2x + 1$ and check with a graph.

REVIEW

15. Solve for x: $1.05^x = 1000$. Give an exact answer using logarithms and a decimal to the nearest thousandth.

16. Evaluate: $\log_3 (1/3)$

Lesson 2.4 — Circles and Parabolas from the General Equation

FLUENCY

1. Find the center and radius of the circle $x^2 - 8x + y^2 + 10y + 25 = 0$.

2. Find the center and radius of the circle $x^2 + 8x + y^2 - 4y - 29 = 0$.

3. Find the center and radius of the circle $x^2 + 10x + y^2 - 14y + 38 = 0$.

4. Find the center and radius of the circle $x^2 - 4x + y^2 - 4y - 56 = 0$.

5. Find the center and radius of the circle $x^2 + 16x + y^2 - 8y + 16 = 0$.

6. Complete the square to write $y = x^2 - 6x + 2$ in vertex form, and give the vertex.

7. Complete the square to write $y = x^2 + 8x + 9$ in vertex form, and give the vertex.

8. Find the vertex and focus of $x^2 - 4x - 8y + 20 = 0$.

9. Write $y^2 - 2y - 4x - 7 = 0$ in standard form and state which way it opens.

10. Find the center and radius of $4x^2 + 4y^2 + 8x - 16y - 5 = 0$.

11. Classify each graph: $x^2 + y^2 - 10y = 0$; $y = 3x^2 - 6x$; $2x^2 + 2y^2 = 18$.

APPLICATION

12. A cell tower's coverage edge is $x^2 + y^2 + 10x - 2y + 1 = 0$ (miles). Find its center and range, and decide whether a home at $(-2, 4)$ is covered.

13. A satellite dish is 80 cm across and 10 cm deep. With its vertex at the origin, where is the receiver (the focus)?

14. Two Wi-Fi routers cover $(x - 1)^2 + y^2 \le 16$ and $(x - 8)^2 + y^2 \le 9$ (meters). Is the point $(5, 0)$ covered by both, one or neither?

CHALLENGE

15. Find where the circle $x^2 + y^2 = 25$ meets the line $y = x + 1$.

REVIEW

16. Write as a single logarithm: $4 \log x + \log y - 4 \log z$

17. Solve: $5 / (x + 2) = 8 / (x + 4)$

Unit 2 checkpoint

1. Compared with y = x², y = (x − 3)² + 1 is…
   A. left 3, up 1
   B. right 3, up 1
   C. right 3, down 1
   D. left 3, down 1
2. True or false: f(2x) stretches the graph of f to twice its width.
3. Which is odd?
   A. x² + 1
   B. x³ − x
   C. |x|
   D. x³ + 1
4. The vertex of y = 2|x − 1| − 3 is (_____, _____).

5. Solution of |3x + 1| > 8?
   A. −3 < x < 7/3
   B. x < −3 or x > 7/3
   C. x > 7/3
   D. no solution
6. True or false: |x + 2| = −3 has two solutions.
7. |x − 68| ≤ 4 means _____ ≤ x ≤ _____.
8. Center and radius of x² + y² − 6x + 4y − 12 = 0?
   A. (3, −2), 5
   B. (−3, 2), 5
   C. (3, −2), 12
   D. (6, −4), 5
9. y = 2x² − 12x + 13 in vertex form is y = 2(x − 3)² _____.
10. The focus of (x − 2)² = 8(y − 2) is…
    A. (2, 4)
    B. (2, 0)
    C. (4, 2)
    D. (2, 10)
11. True or false: The arch model’s error E(x) = H(x) − P(x) combines two functions by subtraction.