

Model Matchup

Build rules, classify patterns, and compare outputs.

HIGH SCHOOL • HSF-LE.A

CCSS.Math.Content.HSF-LE.A "Construct and compare linear, quadratic, and exponential models and solve problems"

NAME _____

DATE _____

SPOT THE PATTERN

When x increases by equal amounts, a linear model has a constant additive change, a quadratic model has a constant second difference, and an exponential model has a constant multiplier. Use the pattern to write a rule, then compare rules by evaluating them at the same input.

WORKED EXAMPLE

The table shows a linear relationship. Write its rule. x : 21, 22, 23 y : 71, 75, 79

- Each time x increases by 1, y increases by 4.
- Start with $y = 4x + b$.
- Use (21, 71): $71 = 4(21) + b$, so $b = -13$.

Answer: $y = 4x - 13$

PRACTICE 6 problems

- 1** The table shows a relationship. x : 1, 2, 3 y : 18, 24, 30 Is the model linear, quadratic, or exponential? Write its rule.

ANSWER _____

- 2** The table shows a relationship. x : -8, -7, -6 y : 64, 49, 36 Is the model linear, quadratic, or exponential? Write its rule.

ANSWER _____

- 3** The table shows a relationship. x : 0, 1, 2 y : 5, 15, 45 Is the model linear, quadratic, or exponential? Write its rule.

ANSWER _____

- 4** Which rule is exponential? A. $y = 8x + 9$ B. $y = x^2 - 6$ C. $y = 11 \cdot 2^x$

ANSWER _____

- 5** The models are $f(x) = 18x + 108$ and $q(x) = 6x^2$. Find the positive value of x where the models have the same output.

ANSWER _____

- 6** At $x = 5$, compare $f(x) = 12x$ and $g(x) = 3^x$. Which model has the greater output?

ANSWER _____

APPLY IT Show your work

- 1** Two clubs are promoting events. Club A has 24 sign-ups at day 0 and gets 18 more sign-ups each day. Club B has 6 sign-ups at day 0, and its total sign-ups double each day. Write a model for each club, then state which club has more sign-ups after 5 days.

WORK SPACE

ANSWER _____

- 2** In a basketball video game, the height of a shot is modeled by $h(t) = -5t^2 + 30t$, where h is the height in game units and t is time in seconds. When does the ball return to the floor, and what is its maximum height?

WORK SPACE

ANSWER _____

CHALLENGE One step up

CHALLENGE

For x greater than or equal to 0, compare $L(x) = 12x$, $Q(x) = 2x^2$, and $E(x) = 3^x$. Find every value of x where $L(x) = Q(x)$. At each of those inputs, identify the model with the greatest output. Show your reasoning.

PART 1 • PRACTICE

#	PROBLEM	ANSWER
1	The table shows a relationship. x: 1, 2, 3 y: 18, 24, 30 Is the model linear, quadratic, or exponential? Write its rule.	Linear; $y = 6x + 12$
2	The table shows a relationship. x: -8, -7, -6 y: 64, 49, 36 Is the model linear, quadratic, or exponential? Write its rule.	Quadratic; $y = x^2$
3	The table shows a relationship. x: 0, 1, 2 y: 5, 15, 45 Is the model linear, quadratic, or exponential? Write its rule.	Exponential; $y = 5 \cdot 3^x$
4	Which rule is exponential? A. $y = 8x + 9$ B. $y = x^2 - 6$ C. $y = 11 \cdot 2^x$	C. $y = 11 \cdot 2^x$
5	The models are $f(x) = 18x + 108$ and $q(x) = 6x^2$. Find the positive value of x where the models have the same output.	$x = 6$
6	At $x = 5$, compare $f(x) = 12x$ and $g(x) = 3^x$. Which model has the greater output?	$g(x)$ has the greater output because $f(5) = 60$ and $g(5) = 243$.

PART 2 • APPLY IT

- Club A: $A(d) = 24 + 18d$. Club B: $B(d) = 6 \cdot 2^d$. After 5 days, Club B has more sign-ups: 192 sign-ups versus 114 sign-ups.** Evaluate $A(5) = 24 + 18(5) = 114$ and $B(5) = 6 \cdot 2^5 = 192$. Compare the two outputs.
- The ball returns to the floor at 6 seconds. Its maximum height is 45 game units.** Factor $h(t) = -5t(t - 6)$, so the return time is $t = 6$. The vertex occurs at $t = 3$, and $h(3) = 45$.

CHALLENGE

$L(x) = Q(x)$ when $12x = 2x^2$, so $2x(x - 6) = 0$. Thus $x = 0$ or $x = 6$. At $x = 0$, $E(0) = 1$ is greater than $L(0) = Q(0) = 0$. At $x = 6$, $E(6) = 729$ is greater than $L(6) = Q(6) = 72$.

Accept equivalent equation forms, including $y = 12 + 6x$ and $y = 5(3^x)$. For the challenge, students should include both nonnegative intersection inputs, 0 and 6.