Name: **Key**  Date: _____ Period: _____

## 4.9 Modeling with Polynomial Functions CYU

☑ Use when you get it right all by yourself

*S* Use when you did it all by yourself, but made a silly mistake

*H* Use when you could do it alone with a little help from teacher or peer

*G* Use when you completed the problem in a group

*X* Use when a question was attempted but wrong (get help)

*N* Use when a question was not even attempted

| CONCEPTS | BASIC | INTERMEDIATE | ADVANCED |
|---|---|---|---|
| Writing a polynomial function from a graph | 1 | 2 | 3 |
| Use finite difference to determine the degree | 4, 6 | 5, 7 | 11 |
| Use the degree to write the polynomial function | 4, 6 | 5, 7 | |
| Error Analysis | | 8 | |
| Writing a polynomial function from coordinates | 6 | 7, 8 | |
| Using the calculator to create a model | 9 | 10 | |

*Write a cubic function whose graph is shown. Show all work to earn full credit.*

1.



$$f(x) = (x+1)(x-1)(x-2)$$

2.



$$f(x) = (x+3)(x+1)(x-2)$$

3.
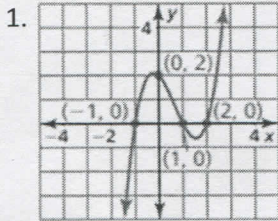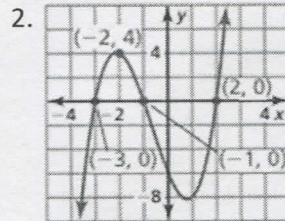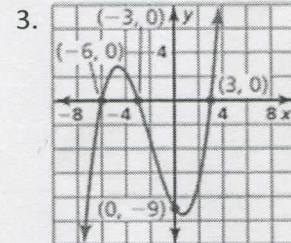


$$f(x) = \tfrac{1}{6}(x+3)(x+6)(x-3)$$

*Use finite differences to determine the degree of the polynomial function that fits the data. Then use technology to write the polynomial function.*

4.

| x | −6 | −3 | 0 | 3 | 6 | 9 |
|---|---|---|---|---|---|---|
| f(x) | −2 | 15 | −4 | 49 | 282 | 803 |

$$3; f(x) = \tfrac{2}{3}x^3 + 4x^2 - \tfrac{1}{3}x - 4$$

5.

| x | −1 | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|---|
| f(x) | −14 | −5 | −2 | 7 | 34 | 91 |

$$3; f(x) = 2x^3 - 3x^2 + 4x - 5$$

6. (- 4, - 317), (- 3, - 37), (- 2, 21), (- 1, 7), (0, - 1), (1, 3), (2, - 47), (3, - 289), (4, - 933)

$$4; f(x) = x^4 - 15x^3 + 81x^2 - 183x + 142$$

7. (- 6, 744), (- 4, 154), (- 2, 4), (0, - 6), (2, 16), (4, 154), (6, 684), (8, 2074), (10, 4984)

$$4; f(x) = \tfrac{1}{2}x^4 - \tfrac{1}{4}x^3 + 2x^2 + 4x - 6$$

**8. ERROR ANALYSIS:** Describe and correct the error in writing a cubic function whose graph passes through the given points.

> $(-6, 0), (1, 0), (3, 0), (0, 54)$
> $54 = a(0 - 6)(0 + 1)(0 + 3)$
> $54 = -18a$
> $a = -3$
> $f(x) = -3(x - 6)(x + 1)(x + 3)$

signs in ( ) are wrong.

$a = 3$

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

**9. MODELING WITH MATHEMATICS:** The table shows the ages of cats and their corresponding ages in human years. Find a polynomial model for the data for the first 8 years of a cat's life. Use the model to estimate the age (in human years) of a cat that is 3 years old.

| Age of cat, x | 1 | 2 | 4 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|
| Human years, y | 15 | 24 | 32 | 40 | 44 | 48 |

$y = -0.22x^2 + 6.4x + 10$

$\approx 27$ yrs old

**10. MODELING WITH MATHEMATICS:** The data in the table show the average speeds y (in miles per hour) of a pontoon boat for several different engine speeds x (in hundreds of revolutions per minute, or RPM's). Find a polynomial model for the data. Estimate the average speed of the pontoon boat when the engine speed is 2800 RPMs.

| x | 10 | 20 | 25 | 30 | 45 | 55 |
|---|---|---|---|---|---|---|
| y | 4.5 | 8.9 | 13.8 | 18.9 | 29.9 | 37.7 |

$y = 0.002x^2 + 0.60x - 2.5$

$\approx 15.9$ mph

**11. MAKING AN ARGUMENT:** Your friend states that it is not possible to determine the degree of a function given the first-order differences. Is your friend correct? Explain your reasoning.

Your friend is incorrect. You continue to find differences until you have a constant.

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**CYU Reflection:** *How far can you go: basic, intermediate, or advanced?*
**Rate your mastery level!**
How confident are you with the skills this CYU covered? Circle the score you would give yourself.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| Basic | | Intermediate | | | Advanced | | Solved ALL! |