Warm-up!

The function R is of the form $R(t) = at$

If 18, write an equation relating a, b, and c that must be true. $18 = a(3)^2 + b(3) + c$

If 3, write an equation relating a, b, and c that must be true. $3 = a(2)^2 + b(2) + c$

If 3, write an equation that must be true. $-3 = a(0)^2 + b(0) + c$

Today:

- Solving Systems with Desmos (FRQ2A)
- More FRQ2B Practice

Homework: Solving Systems with Desmos

Our first test will be Sept 17th (Wednesday) and Sept 18th (Thursday)

$M(t)$ is of the form $M(t) = at^2 + bt + c$

It is given that $M(0) = -3$, $M(2) = 3$, and $M(3) = 18$.

A) Write a system of three equations that may be used to find the values of the constants a, b, and c in the expression for $M(t)$.

$-3 = a(0)^2 + b(0) + c$

$3 = a(2)^2 + b(2) + c$

$18 = a(3)^2 + b(3) + c$

B) Find the values for a, b, and c as decimal approximations.

$R(t)$ is of the form $R(t) = at^3 + bt - \frac{c}{t}$

It is given that $R(1) = -30$, $R(4) = 45$, and $R(6) = 310$.

A) Write a system of three equations that may be used to find the values of the constants a, b, and c in the expression for $R(t)$.

$$-30 = a(1)^3 + b(1) - \frac{c}{1}$$
$$45 = a(4)^3 + b(4) - \frac{c}{4}$$
$$310 = a(6)^3 + b(6) - \frac{c}{6}$$

B) Find the values for a, b, and c as decimal approximations.

$a = 2$ $\qquad$ $b = -20$

$c = 12$

$L(t)$ is of the form $L(t) = a + \frac{b}{t+1}$

It is given that $L(1) = -11$ and $L(6) = 40$.

A) Write a system of two equations that may be used to find the values of the constants a and b in the expression for $L(t)$.

B) Find the values for a and b as decimal approximations.

Mr. Souza posted a pic of the math team on Instagram, and it has gone viral. Every day, he checks how many new comments it got. On the day he posted it ($t = 0$), the post got 10 comments. Two days later ($t = 2$), the post got 51 new comments. Five days after posting ($t = 5$), the post got 45 new comments.

(0, 10)
(2, 51)
(5, 45)

Mr. Souza has reason to believe the number of new comments t days after posting may be modeled well by $C(t) = at^2 + bt + c$.

A) Use the given data to write three equations that can be used to find the values for constants a, b, and c in the expression for $C(t)$.

$10 = a(0)^2 + b(0) + c$

$51 = a(2)^2 + b(2) + c$

$45 = a(5)^2 + b(5) + c$

B) Find the values for a, b, and c as decimal approximations.

$a = -4.5$ $\qquad$ $b = 29.5$

$c = 10$

Mr. Souza posted a pic of the math team on Instagram, and it has gone viral. Every day, he checks how many new comments it got. On the day he posted it ($t = 0$), the post got 10 comments. Two days later ($t = 2$), the post got 51 new comments. Five days after posting ($t = 5$), the post got 45 new comments.

$(2, 51)$
$(5, 45)$

Mr. Souza has reason to believe the number of new comments t days after posting may be modeled well by $C(t) = at^2 + bt + c$.

C) Find the average rate of change of the number of new comments over the interval $2 \leq t \leq 5$.

$$\frac{C(5) - C(2)}{5-2} = \frac{45-51}{5-2} = \frac{-6}{3} = -2$$

D) Use that average rate of change to predict the number of new comments the post got on day $t = 4$.

$(5, 45)$
$(4, C(4))$

$$\frac{C(4) - 45}{4-5} = -2$$

$$\frac{C(4)-45}{-1} = -2 \rightarrow C(4)-45=2$$

$$C(4)=47$$

1. Is this an overapproximation or underapproximation of the value of $C(4)$?

Mr. Souza posted a pic of the math team on Instagram, and it has gone viral. Every day, he checks how many new comments it got. On the day he posted it ($t = 0$), the post got 10 comments. Two days later ($t = 2$), the post got 51 new comments. Five days after posting ($t = 5$), the post got 45 new comments.

Mr. Souza has reason to believe the number of new comments t days after posting may be modeled well by $C(t) = at^2 + bt + c$.

F) Explain why using the average rate of change from part C to predict the number new comments the post received for $2 < t < 5$ leads to underestimates

The iPad was introduced in 2010. Five years later ($t = 5$), 54.9 million iPads were sold. Three years after that ($t = 8$), 43.5 million iPads were sold. After that, Apple no longer shared sales numbers, but industry trackers believe that in 2023 ($t = 13$), 54.1 million iPads were sold.

(5, 54.9)
(8, 43.5)
(13, 54.1)

The number of iPads sold can be modelled by $S(t) = at^3 + bt^2 + ct + 7.5$, where $S(t)$ is the number of iPads sold, in millions, t years after the launch of the product.

A) Use the data given to write three equations that can be used to find the values for the constants a, b, and c in the expression for $S(t)$.

$54.9 = a(5)^3 + b(5)^2 + c(5) + 7.5$
$43.5 = a(8)^3 + b(8)^2 + c(8) + 7.5$
$54.1 = a(13)^3 + b(13)^2 + c(13) + 7.5$

1. Find the values of a, b, and c as decimal approximations.

REGRESSION PARAMETERS

$a = 0.184615$ $\quad b = -4.06$

$c = 25.16462$

The iPad was introduced in 2010. Five years later ($t = 5$), 54.9 million iPads were sold. Three years after that ($t = 8$), 43.5 million iPads were sold. After that, Apple no longer shared sales numbers, but industry trackers believe that in 2023 ($t = 13$), 54.1 million iPads were sold.

(5, 54.9)
(8, 43.5)
(13, 54.1)

The number of iPads sold can be modelled by $S(t) = at^3 + bt^2 + ct + 7.5$, where $S(t)$ is the number of iPads sold, in millions, t years after the launch of the product.

C) Use the given data to find the average rate of change of the number of iPads sold, in millions, from $t = 8$ to $t = 13$. Express your answer as a decimal approximation. Show the computations that lead to your answer.

$\frac{S(13) - S(8)}{13 - 8} = \frac{54.1 - 43.5}{13 - 8} = 2.12$

D) Use $S(13)$ and the average rate of change found in part C to estimate the number of iPads that will be sold in 2025 ($t = 15$). Show the work that leads to your answer.

(13, 54.1)
(15, S(15))

$\frac{S(15) - 54.1}{15 - 13} = 2.12$

$\frac{S(15) - 54.1}{2} = 2.12$

$S(15) - 54.1 = 4.24$

$S(15) = 58.34$

E) Does the value found in part D overestimate or underestimate the value of $S(15)$? Use the concavity of the graph of $S(t)$ to explain why this is the case.