1.13 Function Model Selection

AP Precalculus

1.13 Practice

Select the appropriate model for the data (linear/quadratic/cubic). Explain why it models the data.

1.

x	1	2	3	4	5	6
y	4	15	50	121	240	419

11 35 71 119 179

24 36 48 60

12 12 12

Cubic, third difference constant of 12

2.

x	1	2	3	4	5	6
y	49	46	43	40	37	34

-3 -3 -3 -3 -3

Linear, first difference constant of -3.

3.

x	1	2	3	4	5	6
y	119	110	95	74	47	14

-9 -15 -21 -27 -33

-6 -6 -6 -6

Quadratic, second difference constant of -6

4.

x	2	4	5	6	7	8
y	23	81	122	171	228	293

58 90 122

32 32

Quadratic, second difference constant of 32

CALCULATOR ACTIVE. Use the model to answer the questions in context.

5. A patient receives a dose of painkiller. The function $p(t) = \frac{2t^2+10t}{t^3+1}$ models the amount of painkiller in the blood stream over time, where t is time in hours and p is painkiller in milligrams.

   a. Find $p(2)$. Explain your solution in context.

   $f(2) = 3.111$

   Two hours after taking the painkiller, there was 3.111 mg of painkiller in the blood stream.

   b. What is the average rate of change from $t = 1$ to $t = 2$? Explain your solution in context.

   $\frac{6-3.111}{1-2} = -2.889$ The painkiller is leaving the blood stream at -2.889 mg per hour.

   c. What is the maximum amount of painkiller in the patient's bloodstream?

   6.161 mg

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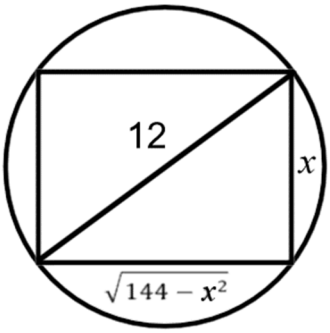
6. A rectangle is inscribed in a circle with diameter of 12 cm. The width of the rectangle is x cm. The function $A(x) = x\sqrt{144 - x^2}$ models the area of the rectangle.



   a. What is the restricted domain of the function?

   $0 \le x \le 12$

   b. What is the restricted range of the function?

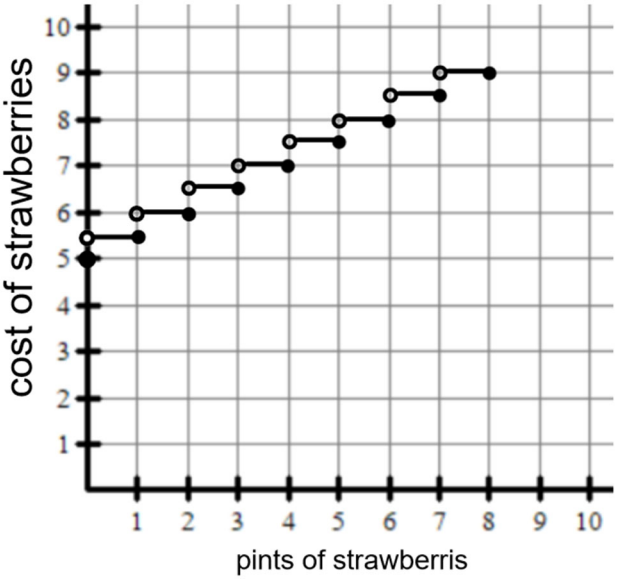
   $0 \le y \le 72$

   c. What is the maximum area of the rectangle?

   $72\ cm^2$

Use the graph of the piecewise function to answer the questions in context.

7. Generic Strawberry Fields allows customers to pay $5 to pick strawberries plus 50 cents for every pint or partial pint of strawberries that they pick. There is a limit of 8 pints per customer. The piecewise function f shown below models the price of strawberries picked.



a. What is the domain in this context?

$0 \leq x \leq 8$ pints of strawberries

b. The range can be represented by $y = 5 + 0.5x$ where x is integers in the domain. Explain why.

The range starts at 5 and increases in increments of 0.50. Using only integers for the domain generates the range of 5, 5.5, 6, 6.5, 7, 7.5, 8, 8.5, 9

c. Find $f(3.5)$. What does it mean in this context?

$f(3.5) = 7$ 3.5 pints of strawberries cost 7 dollars.

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8. The piecewise function f shown below models the insulin levels of a patient over time where $x = 0$ represents 8:00.

a. What is the domain in this context?

$0 \leq x \leq 10$ hours after 8:00

b. What is the range in this context?

This patients insulin levels are $8 \leq y \leq 24$

Possible insulin levels are $0 \leq y \leq around\ 35$ for most patients.

c. Find $f(3)$. What does it mean in this context?

$f(3) = 24$ 3 hours after 8:00 (or 11:00), the patients insulin level is 24 mclU/ml.

d. Find average rate of change from [0, 3]. Explain the meaning in this context.

$\frac{24-8}{3-0} = \frac{16}{3} = 5.333$ The patient's insulin level increased 5.333 levels every hour for the first 3 hours.

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1.13 Test Prep

Multiple Choice - CALCULATOR ACTIVE

For questions 9 and 10, use the table of values for polynomial f at selected values of x.

x	2	4	6	8	10	12
$f(x)$	97	405	977	1861	3105	4757

9. Which of the following statements are true ?

(A) The function is quadratic because second differences are a nonzero constant

(B) The function is quadratic because third differences are a nonzero constant

(C) The function is cubic because second differences are a nonzero constant

(D) The function is cubic because third differences are a nonzero constant

10. The average rate of change from $x = -22$ to $x = 4$ is 34. Which statement best describes the $f(x)$?

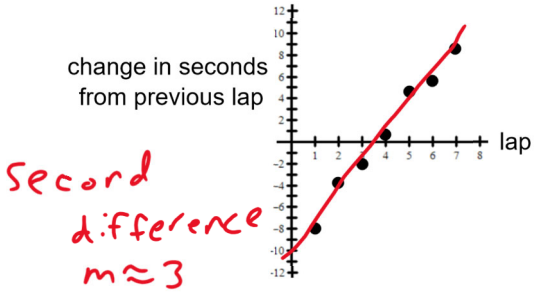
(A) There must be at least one zero on the interval $[-22, 4]$ because $f(-22)$ is negative.

(B) The number of zeros on the interval $[-22, 4]$ cannot be determined because $f(-22)$ is positive.

(C) There must be at least one zero on the interval $[-22, 4]$ because the average rate of change is negative.

(D) There is at least one zero in that interval$[-22, 4]$ because the average rate of change is positive.

11. A track athlete is running laps. The graph shows the average rate of change from the previous lap.



A function model T is constructed for the time of each lap. Which of the following statements best supports the selection of the model of a model for T

(A) Since the rate of change is roughly linear, a linear model is best for T.

(B) Since the rate of change is roughly linear, a quadratic model is best for T.

(C) Since the rate of change is roughly linear, a cubic model is best for T.

(D) Since the rate of change is negative and positive, a quadratic model is best for T.