

10. [14 points] Let  $P(t)$  be the price of a house (in thousands of dollars)  $t$  years after it was built. The function  $P(t)$  is given by

$$P(t) = 5t^2 - 18t + 225.$$

- a. [2 points] What is the price of the house five years after it was built? Include units.

*Solution:*  $P(5) = 260$ , then the price is 260 thousand dollars five years after it was built.

- b. [3 points] Find the vertical intercept of the function  $P(t)$  and provide a practical interpretation for it. Include units.

*Solution:* Vertical intercept= $P(0) = 225$ .

**Practical interpretation:** The price of the new house was 225 thousand dollars.

- c. [5 points] Use the method of completing the square to put the formula for  $P(t)$  in vertex form. Show all your algebraic work step-by-step.

*Solution:*

$$\begin{aligned} P(t) &= 5t^2 - 18t + 225. \\ &= 5\left(t^2 - \frac{18}{5}t\right) + 225 \\ &= 5\left(t^2 - \frac{18}{5}t + (1.8)^2 - (1.8)^2\right) + 225 \\ &= 5\left((t - 1.8)^2 - (1.8)^2\right) + 225 \\ &= 5(t - 1.8)^2 - 5(1.8)^2 + 225 \\ &= 5(t - 1.8)^2 + 208.8. \end{aligned}$$

*Problem continued from the previous page.*

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d. [2 points]

What is the highest price of the house during the first 5 years after it was built? In what year was the highest price attained?

*Solution:* After 5 years:

Highest price = 260 thousand dollars.

Highest price of the house when  $t = 5$ .

e. [2 points]

What is the lowest price of the house during the first 5 years after it was built? In what year was the lowest price attained?

*Solution:* The minimum of  $P(t)$  is at the vertex  $(1.8, 208.8)$

Lowest price = 208.8 thousand dollars (208,800 dollars)

Lowest price of the house when  $t = 1.8$ .