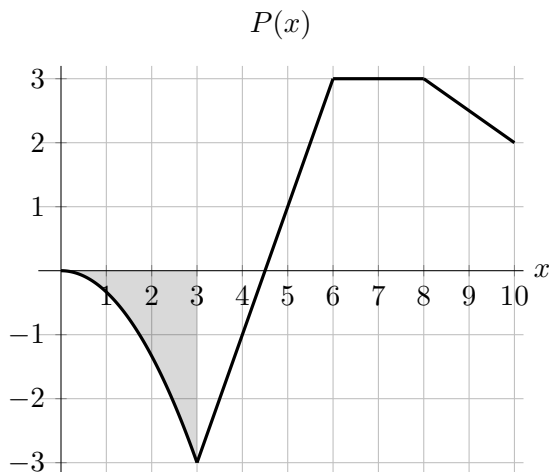


1. [13 points] The function  $P(x)$  is defined on the interval  $-14 \leq x \leq 14$ . The graph of  $P(x)$  is shown below for  $0 \leq x \leq 10$ .



The function  $P(x)$  has the following properties:

- it is an even function,
- the shaded region has area equal to 3,
- $P(x)$  is twice differentiable on  $(9, 14)$  and  $P$ ,  $P'$ , and  $P''$  have the following values

|          |      |      |     |     |
|----------|------|------|-----|-----|
| $x$      | 10   | 11   | 12  | 13  |
| $P(x)$   | 2    | 2.5  | 3   | 4   |
| $P'(x)$  | -0.5 | 0.2  | -2  | 1.5 |
| $P''(x)$ | 0    | -0.5 | 1.7 | 2.5 |

In the following questions, your answers must be **exact**. If any of the answers are undefined, write “UND”. If there is not enough information to answer a question, write “NEI”.

a. [2 points] Find  $\lim_{m \rightarrow 0} \frac{P(m + 12) - P(12)}{m}$ .

Answer: \_\_\_\_\_

b. [2 points] Let  $J(x)$  be an antiderivative of  $P(x)$ . Find  $J'(3)$ .

Answer: \_\_\_\_\_

c. [2 points] Let  $K(x)$  be an antiderivative of  $P(x)$  with  $K(8) = -2$ . Find  $K(0)$ .

Answer: \_\_\_\_\_

d. [3 points] Find  $\int_{-3}^6 (2P(t) + 1) dt$ .

Answer: \_\_\_\_\_

e. [2 points] Find  $\int_{10}^{13} P''(x) dx$ .

Answer: \_\_\_\_\_

f. [2 points] Let  $Q(x) = P(3x^2 + 1)$ . Find  $Q'(2)$ .

Answer: \_\_\_\_\_