LESSON MAKER PRO

Peak Point Patrol

Use derivatives and endpoints to locate high and low points.

HIGH SCHOOL · MA.912.C.3.4

MA.912.C.3.4 "Find local and absolute maximum and minimum points of a function."

NAME _____ DATE _____

CHECK EVERY CANDIDATE

For a local maximum or minimum, look for interior critical points where f'(x) = 0 or f'(x) is undefined, then check whether the function changes direction. On a closed interval, absolute extrema can occur at critical points or endpoints, so evaluate the function at every candidate and compare the values.

WORKED EXAMPLE

Find the absolute maximum and absolute minimum of $g(x) = x^2 - 10x + 17$ on $[2, 9]$.

1. Find critical points: g'(x) = 2x - 10, so 2x - 10 = 0 gives x = 5.
2. Evaluate the endpoints and critical point: g(2) = 1, g(5) = -8, and g(9) = 8.
3. Compare the three values.

Answer: Absolute maximum: (9, 8). Absolute minimum: (5, -8).

PRACTICE 6 problems

1 Find the absolute maximum and absolute minimum of $f(x) = x^2 - 6x + 2$ on $[0, 5]$.

ANSWER _____

2 Find the local maximum and local minimum points of $f(x) = x^3 - 3x^2 - 9x + 4$.

ANSWER _____

3 Find the absolute maximum and absolute minimum of $f(x) = -x^2 + 4x + 1$ on $[-1, 6]$.

ANSWER _____

4 Find the absolute maximum and absolute minimum of $f(x) = x^3 - 12x$ on $[-3, 4]$.

ANSWER _____

5 Find the absolute maximum and absolute minimum of $h(x) = x^3 + 3x^2 - 24x$ on $[-5, 3]$.

ANSWER _____

6 Find the absolute maximum and absolute minimum of $q(x) = x + 9/x$ on $[1, 9]$.

ANSWER _____

APPLY IT Show your work

1 A student council fundraiser models its profit by $P(x) = -100x^2 + 1800x - 3500$, where x is the number of dozens of snack boxes sold and $0 <= x <= 12$. Find the absolute maximum and absolute minimum profit.

WORK SPACE

ANSWER _____

2 A game club models its app engagement score by $M(t) = -3t^2 + 18t + 12$, where t is weeks after a new game is released and $0 <= t <= 6$. Find the absolute maximum and absolute minimum engagement scores.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For $f(x) = x^3 - 6x^2 + 9x + 2$ on $[0, 5]$, find all local maximum and minimum points, then find the absolute maximum and absolute minimum points.

WORK SPACE AND ANSWER

ANSWER KEY

Peak Point Patrol

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find the absolute maximum and absolute minimum of $f(x) = x^2 - 6x + 2$ on $[0, 5]$.	**Absolute maximum: (0, 2). Absolute minimum: (3, -7).**
2	Find the local maximum and local minimum points of $f(x) = x^3 - 3x^2 - 9x + 4$.	**Local maximum: (-1, 9). Local minimum: (3, -23).**
3	Find the absolute maximum and absolute minimum of $f(x) = -x^2 + 4x + 1$ on $[-1, 6]$.	**Absolute maximum: (2, 5). Absolute minimum: (6, -11).**
4	Find the absolute maximum and absolute minimum of $f(x) = x^3 - 12x$ on $[-3, 4]$.	**Absolute maximum: (-2, 16) and (4, 16). Absolute minimum: (2, -16).**
5	Find the absolute maximum and absolute minimum of $h(x) = x^3 + 3x^2 - 24x$ on $[-5, 3]$.	**Absolute maximum: (-4, 80). Absolute minimum: (2, -28).**
6	Find the absolute maximum and absolute minimum of $q(x) = x + 9/x$ on $[1, 9]$.	**Absolute maximum: (1, 10) and (9, 10). Absolute minimum: (3, 6).**

PART 2 · APPLY IT

1. **Absolute maximum profit: $4,600 when x = 9 dozen boxes. Absolute minimum profit: -$3,500 when x = 0 dozen boxes.** Set $P'(x) = -200x + 1800$ equal to 0 to get $x = 9$. Compare $P(0) = -3500$, $P(9) = 4600$, and $P(12) = 3700$.
2. **Absolute maximum: 39 points at t = 3 weeks. Absolute minimum: 12 points at t = 0 weeks and t = 6 weeks.** Set $M'(t) = -6t + 18$ equal to 0 to get $t = 3$. Compare $M(0) = 12$, $M(3) = 39$, and $M(6) = 12$.

CHALLENGE

Local maximum: (1, 6). Local minimum: (3, 2). Absolute maximum: (5, 22). Absolute minimum: (0, 2) and (3, 2).

Accept equivalent ordered-pair notation and correctly labeled function values with their x-values. For closed-interval questions, students must test both endpoints and all critical points in the interval.