Just In Time Quick Check
Standard of Learning (SOL) AII.7b

Strand: Functions

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The student will investigate and analyze linear, quadratic, absolute value, square root, cube root, rational, polynomial, exponential, and logarithmic function families algebraically and graphically. Key concepts include intervals in which a function is increasing or decreasing.

Grade Level Skills:

- Given the graph of a function, identify intervals on which the function (linear, quadratic, absolute value, square root, cube root, polynomial, exponential, and logarithmic) is increasing or decreasing.
- Investigate and analyze characteristics and multiple representations of functions with a graphing utility.

Just in Time Quick Check

## Just in Time Quick Check Teacher Notes

Supporting Resources:

- VDOE Mathematics Instructional Plans (MIPS)
    - AII.7bc - Functions: Extrema, Intervals Increasing and Decreasing (Word) / PDF Version
- VDOE Word Wall Cards: Algebra II   (Word) | (PDF)
    - Increasing/Decreasing
- VDOE Rich Mathematical Tasks: Algebra II
    - A2.6 Function of a Ride Task Template (Word) / PDF Version
- Desmos Activity
    - Polygraph: Polynomial Functions

Supporting and Prerequisite SOL: AII.6a, AII.7a, A.6a, 8.16a
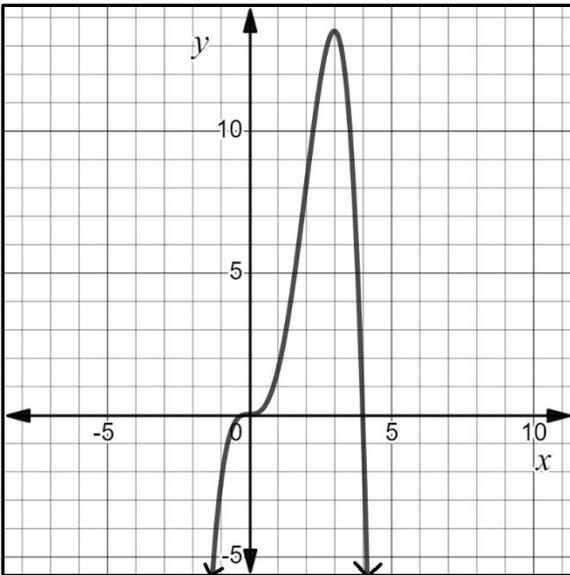
SOL AII.7b - Just in Time Quick Check

1. Sketch the graph of a function $g(x)$ that is:
   - decreasing throughout the interval $(-\infty, 2)$
   - increasing throughout the interval $(2,3)$
   - decreasing throughout the interval $(3, \infty)$.
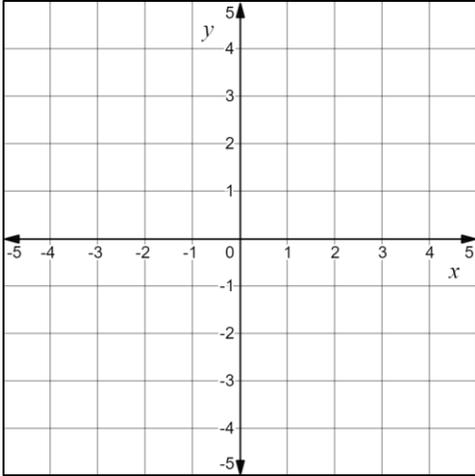
2. The function $f(x) = -\frac{1}{4}x^4 + 2x^3$ is shown.

Write the intervals where the graph is:
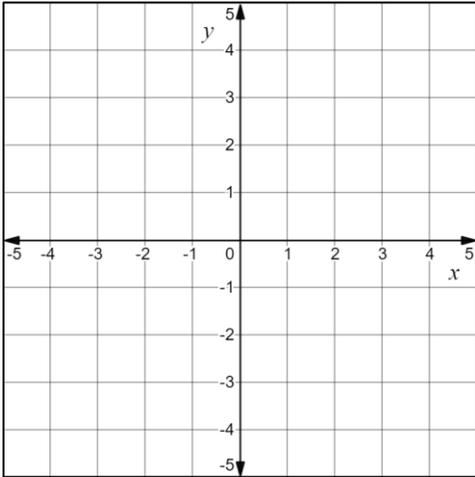
- only decreasing
- only increasing.

Decreasing Interval	Increasing Interval

3. Identify the intervals on which the function $f(x) = (x - 1)(x + 2)^2$ appears to be always increasing. Select all correct intervals.

$4 < x < 8$	$-2 < x < 0$	$-\infty < x < -2$	$-\infty < x < \infty$

1. Sketch the graph of a function $g(x)$ that is:
    - decreasing throughout the interval $(-\infty, 2)$
    - increasing throughout the interval $(2,3)$
    - decreasing throughout the interval $(3, \infty)$.

A common error some students may make is to have the graph turning at points (x, 2) and (x, 3). This may indicate a misunderstanding in using the y-values to name intervals when describing whether a function is increasing or decreasing. A strategy that may benefit some students is to draw vertical lines through the turning points intersecting the x-axis to indicate parts of the domain that are used in naming the intervals in which the graph is increasing/decreasing. Desmos would be beneficial to use for illustrating the given function and drawing vertical lines at turning point locations to emphasize that the domain values are associated with increasing/decreasing intervals.

2. The function $f(x) = -\frac{1}{4}x^4 + 2x^3$ is shown.
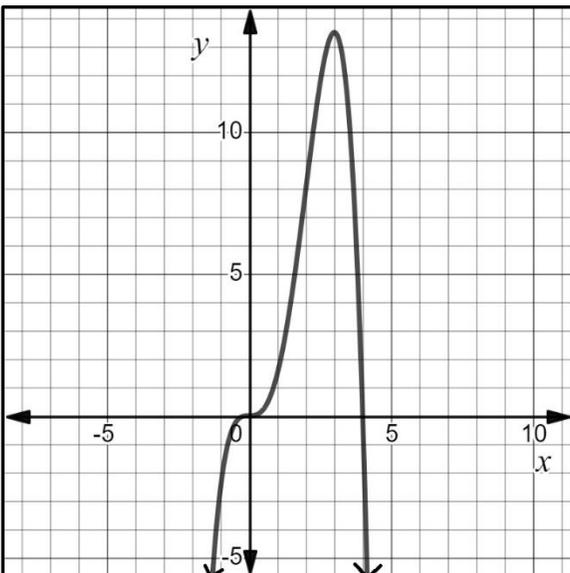
Write the intervals where the graph is:

- only decreasing
- only increasing.

Decreasing Interval	Increasing Interval

A common error some students might make is to state an increasing interval of $-\infty < x < 3$. This may indicate a misunderstanding that (0, 0) is included in the interval however, f(x) is not consistently increasing over the entire interval from $-\infty < x < 3$. A possible teaching strategy would be to remind students to read graphs from left to right when describing increasing/decreasing intervals. Using a highlighter to indicate where the graph is rising (consistently increasing) may help some students. In addition, the students could examine what is happening to the y-values as the x values are increasing. Use the Desmos slider feature to visually show students the results as the x-values increase, what is happening to the corresponding y-values. Ask students questions like - At what value does the function begin to decrease? At what value(s) does the function not consistently increase or consistently decrease?

3. The function $f(x) = (x - 1)(x + 2)^2$ is increasing throughout which intervals, select all that apply -

$4 < x < 8$	$-2 < x < 0$	$-\infty < x < -2$	$-\infty < x < \infty$

A common error some students might make is not selecting $4 < x < 8$ as an increasing interval. This misconception may happen because some students only recognize intervals that connect turning points. A possible teaching strategy is to show students that the y-value is increasing at each x-value from 4 to 8 by using an input/output table.