5 Increasing, decreasing, and turning points – Part 1

Name: ______________ Class: __________ Date: ____________

Recall

The derivative gives the slope of a curve – and the slope tells you a lot:

- Where a graph goes uphill, the slope is positive.
- At the very top of a hill, the graph is momentarily flat.
- Businesses want to find the "best" (maximum or minimum) point.

This sheet uses the derivative to find high and low points. Each idea has a worked example.

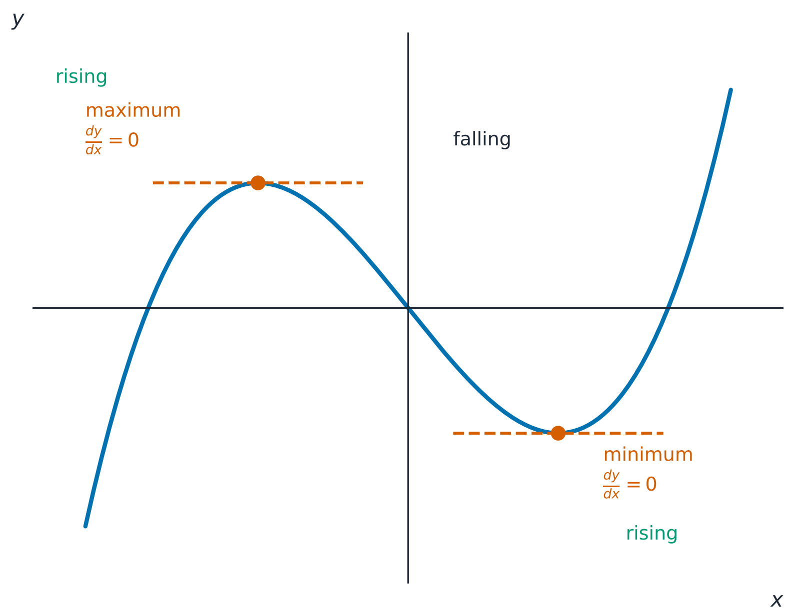
New ideas

1 Increasing and decreasing

- Where the derivative $f'(x) > 0$, the function is **increasing** (going uphill).
- Where $f'(x) < 0$, it is **decreasing** (going downhill).

2 Stationary points

Where $f'(x) = 0$, the curve is momentarily **flat** – a **stationary point** (a peak or a valley).



3 Finding a maximum or minimum

To find high and low points: differentiate, set $f'(x) = 0$, and solve for x.

Worked example. For $f(x) = x^2 - 4x$: $f'(x) = 2x - 4$. Setting $2x - 4 = 0$ gives $x = 2$ – the minimum point of this parabola.

4 Peak or valley?

Check the slope just before and after: if it changes from positive to negative, it is a **maximum**; from negative to positive, a **minimum**.

Watch out: a stationary point ($f' = 0$) can be a maximum **or** a minimum (or neither). Finding where $f'(x) = 0$ locates the point; you still have to check which kind it is.

Practice

Try these in order. The methods are all above.

2.1 State what the sign of $f'(x)$ tells you about the graph. [2]

2.2 State what is true about the derivative at a stationary point. [1]

2.3 For $f(x) = x^2 - 6x$, find $f'(x)$ and the x-value where it is zero. [3]

2.4 For $f(x) = x^2 + 2x$, find the x-value of the stationary point. [2]

2.5 State how you decide whether a stationary point is a maximum or a minimum. [2]