2 The power rule – Part 2

Name: _____ Class: _____ Date: _____

Recall

In Part A you learned that the derivative is the slope of a curve. Now compute it quickly with a rule:

- Finding a slope from scratch each time would be slow.
- A simple rule handles powers of x.

Each idea has a worked example before the Practice.

New ideas

1 The power rule

To differentiate a power of x, multiply by the power and lower the power by one:

$$\frac{d}{dx}\,x^n = n\,x^{\,n-1}.$$

Worked example. $\frac{d}{dx}\,x^3 = 3x^2$, and $\frac{d}{dx}\,x^5 = 5x^4$.

2 Constants

The derivative of a **constant** is 0 (a flat line has zero slope). A constant multiplier stays: $\frac{d}{dx}(5x^2) = 10x$.

3 Sums

Differentiate a sum term by term.

Worked example. $\frac{d}{dx}(x^2 + 3x) = 2x + 3$.

4 Reading the result

The derivative is itself a function – put in an x value to get the slope there.

Worked example. For $f(x) = x^2$, $f'(x) = 2x$, so the slope at $x = 3$ is $f'(3) = 6$.

Watch out: the power rule **lowers** the power by one and **multiplies** by the old power. A common slip is to forget the multiply – $\frac{d}{dx}x^4$ is $4x^3$, not x^3.

Practice

Try these in order. The methods are all above.

2.1 Find $\frac{d}{dx} x^4$. [2]

2.2 Find $\frac{d}{dx} x^7$. [1]

2.3 Find the derivative of $f(x) = x^2 + 5x$. [2]

2.4 Find the derivative of $f(x) = 3x^2$. [2]

2.5 For $f(x) = x^2$, find the slope of the curve at $x = 4$. [2]