Differentiating Polynomials

Starter

1. Without a calculator find: (a) $\frac{7}{2} - 1$ (b) $\frac{11}{3} - 1$ (c) $\frac{3}{7} - 1$

(d) $\frac{4}{9} - 1$ (e) $-\frac{8}{11} - 1$ (f) $-\frac{15}{4} - 1$

Notes

Notation

The first derivative is denoted by $\frac{dy}{dx}$ ("dee why by dee ex") or $f'(x)$ ("eff dash of ex" or simply "eff dashed")

Quick method for differentiating a polynomial

It is too laborious to differentiate from first principles every time we want to find the derivative of a function. By inspection, the method for differentiating polynomials can be seen.

Function	Derivative
x^2	2x
6x	6
$x^2 + 1$	2x
$x^2 - 6x$	$2x - 6$
$x^2 - 3x + 4$	$2x - 3$
x^3	$3x^2$

Differentiating polynomials: $y = kx^n \Rightarrow \frac{dy}{dx} = knx^{n-1}$

Poetry: ***The power multiplies the coefficient,***
And decrease the power by 1.

Differentiating a constant: $y = k \Rightarrow \frac{dy}{dx} = 0$ ***horizontal line = zero gradient***

Differentiating a linear function: $y = kx \Rightarrow \frac{dy}{dx} = k$ **gradient of a straight line is the coefficient of x**

E.g. 1 Find the first derivative of these functions:

(a) $y = x^5$ (b) $f(x) = 7x^4$ (c) $y = x^{-7}$ (d) $f(x) = -5x^{-4}$

(e) $y = x^{\frac{3}{2}}$ (f) $f(x) = x^{\frac{1}{4}}$ (g) $y = x^{-\frac{4}{3}}$ (h) $f(x) = 12x^{-\frac{1}{6}}$

Working:

(a) $\frac{dy}{dx} = 5x^{5-1} = 5x^4$

(b)

(c) $\frac{dy}{dx} = -7x^{-7-1} = -7x^{-8}$

(d)

(e) $\frac{dy}{dx} = \frac{3}{2}x^{\frac{3}{2}-1} = \frac{3}{2}x^{\frac{1}{2}}$

(f)

(g)

(h)

N.B. In your working you can miss out the middle step and go straight to the answer.

Video: Differentiating polynomials
Video: Differentiating polynomials EQ

Solutions to Starter and E.g.s

Exercise
p257 13C Qu 1i, 2i, 3i, 4-6

Summary

The first derivative is denoted by $\frac{dy}{dx}$ or $f'(x)$

Differentiating polynomials: $y = kx^n \Rightarrow \frac{dy}{dx} = knx^{n-1}$

Poetry: ***The power multiplies the coefficient,***
And decrease the power by 1.

Differentiating a constant: $y = k \Rightarrow \frac{dy}{dx} = 0$

Differentiating a linear function: $y = kx \Rightarrow \frac{dy}{dx} = k$