# Do Now

The following is a chart of the temperature of a cup of coffee as it cools.

| | | | | | | |
|---|---|---|---|---|---|---|
| X | t (minutes) | 0 | 2 | 5 | 9 | 10 |
| Y | H(t) (degrees Celcius) | 66 | 60 | 52 | 44 | 43 |

slope = AROC

a.) Find the average rate of change over the interval [5, 10]. Interpret the meaning of your answer.

average rate

$-\frac{9}{5}$ °C/min / The temp drops $\frac{9}{5}$ °C every minute over the interval [5,10]

b.) Approximate the derivative at t=1. Interpret the meaning of your answer.

IROC

$-3$°C/min / The derivative at t=1 is approximately $-3$°C/min

c.) Approximate the instantaneous slope at t=2. interpret the meaning of your answer.

AIMS: - use the power rule to find derivatives

# Unit 2.5 - The Power Rule for finding Derivative

## I. The Power Rule

$\frac{d}{dx}(x^2) = 2x$

take the derivative with respect to x

$\frac{d}{dx}(2x^3) = 6x^2$

Power Rule: $\frac{d}{dx}(kx^n) = nkx^{n-1}$

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

$\frac{d}{dx}(\frac{1}{2}x^{0.3}) = 0.15x^{-.7}$

$\frac{d}{dx}(\frac{\sqrt{x}}{2}) = \frac{1}{2}x^{1/2}$

$\frac{d}{dx}(kx^n) = \frac{d}{dx}(\frac{1}{2}x^{\frac{1}{2}}) = \frac{1}{4}x^{-1/2}$

Find $\frac{dy}{dx}$ for the following functions:

1.) $y = -3x^{12}$ 2.) $y = 3x^8 + 2x + 1$ 3.) $y = \frac{1}{2}(x^4 + 7)$ 4.) $y = x^{-3} + \frac{1}{x^7}$

$y = \frac{1}{2}x^4 + 3.5x^0$ $y = x^{-3} + x^{-7}$

$\frac{dy}{dx} = 2x^3$ $\frac{dy}{dx} = -3x^{-4} - 7x^{-8}$

$$f(x) = \frac{3x^2}{4x^{-2}} + \frac{16x^2}{\sqrt[4]{x}} - \frac{\sqrt[3]{8x}}{x}$$

$f(x) = \frac{3}{4}x^4 + 16x^{7/4} - 2x^{2/3}$

$f'(x) = 3x^3 + 28x^{3/4} + \frac{4}{3}x^{-5/3}$

$f'(0) = 0$

$$f(x) = ax^3 + bx^2 + cx + d$$

Find the value of the derivative of the following functions at x=1

$y = \dfrac{x^{\frac{3}{2}} + 2}{x}$

$y = (x^{3/2} + 2)x^{-1}$

$= x^{3/2}x^{-1} + 2x^{-1}$

$f(x) = 1 + x + x^2 + x^3 + x^4 + x^5$

$y = \dfrac{x^{3/2}}{x} + \dfrac{2}{x}$

$y = \dfrac{x^2 + 1}{5}$

$f(x) = \dfrac{1 + x + x^2 + x^3 + x^4 + x^5 + x^6}{x^3}$

General ideas about derivatives to keep in mind:

**Equations of tangent and normal lines:** → = perpendicular

Find the line tangent to $y = 3x^8 + 2x + 1$ at x=1

$2x^1 \rightarrow 2$

point

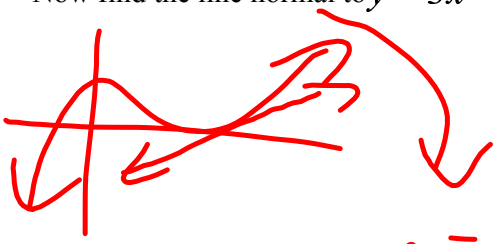
$(1, 6)$

slope

$\frac{dy}{dx} = 24x^7 + 2$

$\left.\frac{dy}{dx}\right|_{x=1} = 26$

Now find the line normal to $y = 3x^8 + 2x + 1$ at x=1



$m = -\frac{1}{26}$

$y - 6 = 26(x - 1)$

**AP Question:**

Let $f(x) = 4x^3 - 3x - 1$. An equation of the line tangent to $y = f(x)$ at $x = 2$ is

a.) $y = 25x - 5$

b.) $y = 45x + 65$

c.) $y = 45x - 65$

d.) $y = 65 - 45x$

e.) $y = 65x - 45$

AIMS: - use the power rule to find derivatives

# TTL

1.) Find the equation of the line normal to $f(x) = -\frac{1}{2}x^4 - 9x + 8$ at x=1