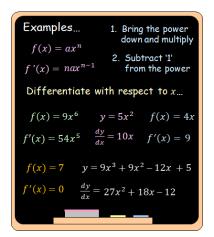
## Outcome 1 - Basic Differentiation

### Bronze examples



### Bronze questions

Differentiate the following with respect to  $x_{\cdots}$ 



$$f(x) = 3x^9 \qquad \text{ } f(x) = x^3 - 2x^2 + 5x + 18$$

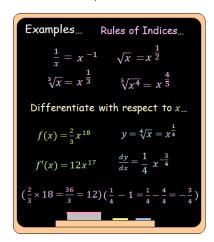
$$f(x) = 15x \qquad \qquad f(x) = 2x^3 + 8x^2 - 4x - 11$$

$$y = 20$$
  $y = 5x^3 - x + 7$ 

$$f(x) = 7x^{-2} \quad f(x) = 3x^5 + 6x^3 - 10x + 1$$

## Outcome 2 - Differentiation with fractions and indices

## Silver examples



### Silver questions

Differentiate the following with respect to  $x_{...}$ 



$$y = \frac{1}{3}x^{15} \qquad f(x) = \frac{1}{10}x^{\frac{1}{2}}$$

$$f(x) = \sqrt[7]{x}$$

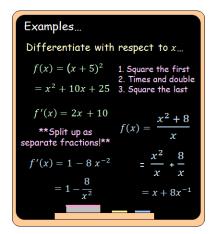
$$f(x) = \sqrt[10]{x}$$

$$y = 5\sqrt[3]{x}$$
 **8**  $f(x) = \sqrt{x^9}$ 

$$y = \frac{6}{\sqrt{x}} \qquad f(x) = \frac{4}{\sqrt{x}}$$

# Outcome 3 - Harder Differentiation!

### Gold examples



### Gold questions

Differentiate the following with respect to  $x_{\dots}$ 

$$f(x) = 4(x+11)$$
 2  $f(x) = 3x(x-9)$ 

$$f(x) = (x+5)^2 y = (3x-2)^2$$

$$f(x) = (x+9)(x-2) \qquad \text{ff} \qquad f(x) = 2x(x-4)^2$$

$$y = \frac{x^9 - 3}{x}$$
  $g(x) = \frac{x^6 + 1}{x^2}$ 

$$f(x) = \frac{x^8 + 10}{\sqrt{x}} \qquad \text{10} \qquad y = \frac{x^2 + x}{\sqrt[7]{x}}$$

## Bronze Answers

1. 
$$f'(x) = 11x^{10}$$
 2.  $\frac{dy}{dx} = -x^{-2}$ 

2. 
$$\frac{dy}{dx} = -x^{-2}$$

3. 
$$f'(x) = 27x^8$$

3. 
$$f'(x) = 27x^8$$
 4.  $f'(x) = 3x^2 - 4x + 5$ 

5. 
$$f'(x) = 15$$

5. 
$$f'(x) = 15$$
 6.  $f'(x) = 6x^2 + 16x - 4$ 

7. 
$$\frac{dy}{dy} = 0$$

7. 
$$\frac{dy}{dx} = 0$$
 8.  $\frac{dy}{dx} = 15x^2 - 1$ 

9. 
$$f'(x) = -14x^{-3}$$

9. 
$$f'(x) = -14x^{-3}$$
 10.  $f'(x) = 15x^4 + 18x^2 - 10$ 

### Silver Answers

1. 
$$f'(x) = \frac{3}{5}x^{-\frac{2}{5}}$$
 2.  $f'(x) = 10x^{11}$ 

2. 
$$f'(x) = 10x^{11}$$

3. 
$$\frac{dy}{dx} = 5x^{14}$$

3. 
$$\frac{dy}{dx} = 5x^{14}$$
 4.  $f'(x) = \frac{1}{30}x^{-\frac{2}{3}}$ 

5. 
$$f'(x) = \frac{1}{7}x^{-\frac{6}{7}}$$

5. 
$$f'(x) = \frac{1}{7}x^{-\frac{6}{7}}$$
 6.  $f'(x) = \frac{1}{10}x^{-\frac{9}{10}}$ 

7. 
$$\frac{dy}{dx} = \frac{5}{3}x^{-\frac{2}{3}}$$
 8.  $f'(x) = \frac{9}{2}x^{\frac{7}{2}}$ 

8. 
$$f'(x) = \frac{9}{2}x^{\frac{7}{2}}$$

9. 
$$\frac{dy}{dx} = -3x^{-\frac{3}{2}}$$
 10.  $f'(x) = -x^{-\frac{5}{4}}$ 

10. 
$$f'(x) = -x^{-\frac{5}{4}}$$

#### Gold Answers

1 
$$f'(x) = 4$$

1. 
$$f'(x) = 4$$
 2.  $f'(x) = 6x - 27$ 

3. 
$$f'(x) = 2x + 10$$
 4.  $\frac{dy}{dx} = 18x - 12$ 

4. 
$$\frac{dy}{dx} = 18x - 12$$

5. 
$$f'(x) = 2x + 7$$

5. 
$$f'(x) = 2x + 7$$
 6.  $f'(x) = 6x^2 - 32x + 32$ 

7. 
$$\frac{dy}{dx} = 8x^7 + 3x^{-2}$$
 8.  $f'(x) = 4x^3 - 2x^{-3}$ 

8. 
$$f'(x) = 4x^3 - 2x^{-3}$$

9. 
$$f'(x) = \frac{15}{2}x^{\frac{13}{2}} - 5x^{-\frac{3}{2}}$$
 10.  $\frac{dy}{dx} = \frac{13}{7}x^{\frac{6}{7}} + \frac{6}{7}x^{-\frac{1}{7}}$ 

10. 
$$\frac{dy}{dx} = \frac{13}{7}x^{\frac{6}{7}} + \frac{6}{7}x^{-\frac{1}{7}}$$