Differentiation

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The presentation will consist of some practice questions on differentiation and tangent lines.

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Find the derivative of each of the following functions:

• $f(x) = 2x^2 - 3x^5$. This one is very simple:

 $f'(x) = 2 \times 2x^1 - 3 \times 5x^4 = 4x - 15x^4$

• $f(x) = 3x + 1 - \frac{1}{x}$. We first rewrite $f(x) = 3x + 1 - x^{-1}$, now we have:

 $f'(x) = 3 + 0 - (-1)x^{-2} = 3 + \frac{1}{x^2}$

 $f(x) = \frac{x^2}{2} + \frac{4}{x^2}$. We rewrite $f(x) = \frac{1}{2}x^4 + 4x^{-2}$, we have:

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$$f(x) = \frac{1}{2x^4} + 2x + 6.$$

 $f'(x) = 5 \times (-1)x^{-2} + 3 \times 2x^{1} - \frac{1}{2} \times (-4)x^{-5} = -\frac{3}{2} + 6x$

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$$f'(x) = 5 \times (-1)x^{-2} + 3 \times 2x^{1} - \frac{1}{3} \times (-4)x^{-5} = -\frac{5}{x^{2}} + 6x + \frac{4}{3x^{5}}$$

Find the gradient of $f(x) = 3x^2 - 5x + 1$ at (1, -1).

 $f'(x) = 3 \times 2x^1 - 5 + 0 = 6x - 5$

Now we want to find the gradient at (1, -1), so when x = 1. The gradient is

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Find the gradient of $f(x) = 2x + 1 - \frac{2}{x}$ at (2,4).

$$f'(x) = 2 + 0 - 2 \times (-1)x^{-2} = 2 + \frac{2}{x^2}$$

Now we want to find the gradient at (2, 4), so when x = 2. The gradient is

$$f'(2) = 2 + \frac{2}{2^2} = 2.5$$

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Now we want to find the gradient at (2, 4), so when x = 2.

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Now we want to find the gradient at (2, 4), so when x = 2. The gradient is

$$f'(2) = 2 + \frac{2}{2^2} = 2.5$$

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Find the gradient of $f(x) = \frac{1}{x^3} - \frac{1}{x^2}$ at (1,0).

Now we want to find the gradient at (1,0), so when x = 1. We substitute x = 1 into the gradient function and we get that the gradient is

$$f'(2) = -\frac{3}{1^4} + \frac{2}{1^3} = -1$$

Find the gradient of $f(x) = \frac{1}{x^3} - \frac{1}{x^2}$ at (1,0). We want to find the gradient function, so we first rewrite $f(x) = x^{-3} - x^{-2}$, so we get



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Find the tangent line to the graph of $f(x) = \frac{1}{3}x^3 - 2x$ at (0, 0).

$$f'(x) = \frac{1}{3} \times 3x^2 - 2 = x^2 - 2$$

So the gradient at (0,0) is

 $f'(0) = 0^2 - 2 = -2$

This means that the gradient of the tangent line will also be -2 (m = -2), so the tangent line will be of the form y = -2x + c. To find c we use the point (0,0) and we get that c = 0. So the tangent line to the graph of $f(x) = \frac{1}{2}x^3 - 2x$ at (0,0) will have the equation:

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$$y = -2x$$

Tomasz Lechowski

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Find the tangent line to the graph of $f(x) = 3x + 1 - \frac{2}{x}$ at (1,2).

$$f'(x) = 3 + 0 - 2 \times (-1)x^{-2} = 3 + \frac{2}{3}x^{-2} = \frac{2$$

So the gradient at (1, 2) is

$$f'(1) = 3 + \frac{2}{1^2} = 5$$

So the gradient of the tangent line will be 5, so it will be of the form y = 5x + c. To find c we use the point (1,2) and we get that $2 = 5 \times 1 + c$, so c = -3. So the tangent line to the graph of $f(x) = 3x + 1 - \frac{2}{2}$ at (1,2) will have the equation:

x = 5x - 3

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Find the tangent line to the graph of $f(x) = 3x + 1 - \frac{2}{x}$ at (1,2). To find the gradient function, we rewrite $f(x) = 3x + 1 - 2x^{-1}$, so:

$$f'(x) = 3 + 0 - 2 \times (-1)x^{-2} = 3 + \frac{2}{\sqrt{2}}$$

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Find the tangent line to the graph of $f(x) = \frac{2}{x} - \frac{3}{2x^2}$ at (1,0.5).

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$$f'(x) = 2 \times (-1)x^{-2} - \frac{3}{2} \times (-2)x^{-3} = -\frac{2}{x^2} + \frac{3}{x^3}$$

So the gradient at (1, 0.5) is

$$f'(1) = -rac{2}{1^2} + rac{3}{1^2} = 1$$

So the gradient of the tangent line will be 1, so it will be of the form y = x + c. To find c we use the point (1,0.5) and we get that 0.5 = 1 + c, so c = -0.5. So the tangent line to the graph of $f(x) = \frac{2}{x} - \frac{3}{2x^2}$ at (1,0.5) will have the equation:

v = x - 0.5

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