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Let's differentiate some functions

Practice Quiz • 20 min • 5 total points

Congratulations! You passed!

Grade received 100% To pass 80% or higher

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1. In the following quiz, you'll apply the rules you learned in the previous videos to differentiate some functions.

1 / 1 point

We learned how to differentiate polynomials using the power rule: $\frac{d}{dx}\left(ax^b\right) = abx^{b-1}$. It might be helpful to remember this as 'multiply by the power, then reduce the power by one'.

Using the power rule, differentiate $f(x) = x^{173}$.

- (selected) $f'(x) = 173x^{172}$
- $f'(x) = 171x^{173}$
- $f'(x) = 172x^{173}$
- $f'(x) = 174x^{172}$

Correct
The power rule makes differentiation of terms like this easy, even for large and scary looking values of b.

2. The videos also introduced the sum rule: $\frac{d}{dx}[f(x) + g(x)] = \frac{df(x)}{dx} + \frac{dg(x)}{dx}$.

1 / 1 point

This tells us that when differentiating a sum we can just differentiate each term separately and then add them together again. Use the sum rule to differentiate $f(x) = x^2 + 7 + \frac{1}{x}$

- $f'(x) = 2x + \frac{1}{x^2}$
- $f'(x) = 2x + 7 - \frac{1}{x^2}$
- (selected) $f'(x) = 2x - \frac{1}{x^2}$
- $f'(x) = 2x + \frac{1}{x}$

Correct
The sum rule allows us to differentiate each term separately.

3. In the videos we saw that functions can be differentiated multiple times. Differentiate the function $f(x) = e^x + 2\sin(x) + x^3$ twice to find its second derivative, $f''(x)$.

1 / 1 point

- $f''(x) = xe^{x-1} - 2\cos(x) + 6x$
- $f''(x) = e^x + 2\cos(x) + 3x^2$
- $f''(x) = e^x + \sin(x) + 3x^2$
- (selected) $f''(x) = e^x - 2\sin(x) + 6x$

Correct
You used the sum rule, power rule and knowledge of some specific derivatives to calculate this. Well done!

4. Previous videos introduced the concept of an anti-derivative. For the function $f'(x)$, it's possible to find the anti-derivative, $f(x)$, by asking yourself what function you'd need to differentiate to get $f'(x)$. For example, consider applying the "power rule" in reverse: You can go from the function abx^{b-1} to its anti-derivative ax^b.

1 / 1 point

Which of the following could be anti-derivatives of the function $f'(x) = x^4 - \sin(x) - 3e^x$? (Hint: there's more than one correct answer...)

- [x] $f(x) = \frac{1}{5}x^5 + \cos(x) - 3e^x + 4$

Correct
Differentiating $f(x)$ gives the intended $f'(x)$. We also see that when calculating anti-derivatives we can add any constant, since the derivative of a constant is zero. We might write this as $f(x) = \frac{1}{5}x^5 + \cos(x) - 3e^x + c$, where c can be any constant.

- [x] $f(x) = \frac{1}{5}x^5 + \cos(x) - 3e^x - 12$

Correct
Differentiating $f(x)$ gives the intended $f'(x)$. We also see that when calculating anti-derivatives we can add any constant, since the derivative of a constant is zero. We might write this as $f(x) = \frac{1}{5}x^5 + \cos(x) - 3e^x + c$, where c can be any constant.

- [ ] $f(x) = 4x^3 - \cos(x) - 3e^x$
- [ ] $f(x) = 5x^5 - \sin(x) + 3e^x + 7$
- [ ] $f(x) = \frac{1}{5}x^5 - \cos(x) - 3e^x + 1$

5. The power rule can be applied for any real value of b. Using the facts that $\sqrt{x} = x^{\frac{1}{2}}$ and $x^{-a} = \frac{1}{x^a}$, calculate $\frac{d}{dx}(\sqrt{x})$.

1 / 1 point

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

Correct
This can also be useful when the power is a negative number. If you'd like to you can check that the power rule agrees with the derivative of $\frac{1}{x}$ that you've already seen.