Let's differentiate some functions

TOTAL POINTS 5

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: $\frac{\mathrm{d}}{\mathrm{d}x}\left(ax^b\right) = abx^{b-1}$. It might be helpful to remember this as 'multiply by the power, then reduce the power by one'.

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

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

   ✓ **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: $\frac{\mathrm{d}}{\mathrm{d}x}\left[f(x) + g(x)\right] = \frac{\mathrm{d}f(x)}{\mathrm{d}x} + \frac{\mathrm{d}g(x)}{\mathrm{d}x}$. **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 $f(x) = x^2 + 7 + \frac{1}{x}$

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

   ✓ **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 $f(x) =$ **1 / 1 point**

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

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

✓ **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...)

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

  ✓ **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.

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

  ✓ **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.

- ☐ $f(x) = 4x^3 - \cos(x) - 3e^x$
- ☐ $f(x) = 5x^5 - \sin(x) + 3e^x + 7$

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

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

✓ **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.