Answers: Introduction to differentiation and the derivative

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Summary

Answers to questions relating to the guide on introduction to differentiation and the derivative.

*These are the answers to* [*Questions: Introduction to differentiation and the derivative*](../questions/qs-introtodifferentiation.qmd)*.*

**Please attempt the questions before reading these answers!**

1.1. $ \frac{d}{dx}\left(x^{3}+5x−3\right)=3x^{2}+5.$

1.2. $ \frac{d}{dx}\left(5x\right)=5.$

1.3. $ \frac{d}{dx}\left(−5\sqrt{x}\right)=−5⋅\frac{1}{2}x^{−1/2}=−\frac{5}{2\sqrt{x}}.$

1.4. $ \frac{d}{dx}\left(−sin\left(x\right)\right)=−cos\left(x\right).$

1.5. $ \frac{d}{dx}\left(cosx+5\right)=−sin\left(x\right).$

1.6. $ \frac{d}{dx}\left(2\sqrt{x}\right)=2⋅\frac{1}{2}x^{−1/2}=\frac{1}{\sqrt{x}}.$

1.7. $ \frac{d}{dx}\left(2ln\left(2x\right)+x^{5}\right)=\frac{2}{x}+5x^{4}.$

1.8. $ \frac{d}{dx}\left(ln\left(5x\right)\right)=\frac{1}{5x}⋅5=\frac{1}{x}.$

1.9. $ \frac{d}{dx}\left(e^{−x}\right)=e^{−x}⋅\left(−1\right)=−e^{−x}.$

1.10. $ \frac{d}{dx}\left(23x+5\right)=23.$

1.11. $ \frac{d}{dx}\left(4x+100\right)=4.$

1.12. For $sinh\left(5x\right)=\frac{e^{5x}−e^{−5x}}{2}$, it follows that

$$\frac{d}{dx}\left(sinh\left(5x\right)\right)=5\frac{e^{5x}+e^{−5x}}{2}=5cosh\left(5x\right)$$

since $cosh\left(x\right)=\frac{e^{x}+e^{−x}}{2}$.

1.13. $ \frac{d}{dx}\left(cos\left(3x\right)−sin\left(2x\right)\right)=−3sin\left(3x\right)−2cos\left(2x\right).$

1.14. $ \frac{d}{dx}\left(ln\left(x\right)+cos\left(x\right)+3x\right)=\frac{1}{x}−sin\left(x\right)+3.$

1.15. $ \frac{d}{dx}\left(\frac{2}{5}sinh\left(x\right)+\frac{2}{13}cosh\left(x\right)\right)=\frac{2}{5}cosh\left(x\right)+\frac{2}{13}sinh\left(x\right).$

1.16. $ \frac{d}{dx}\left(e^{5x}+x^{2}+3\right)=5e^{5x}+2x.$

1.17. $ \frac{d}{dx}\left(ln\left(x\right)+x^{2}\right)=\frac{1}{x}+2x.$

1.18. $ \frac{d}{dx}\left(ln\left(5x\right)−ln\left(x\right)\right)=\frac{1}{x}−\frac{1}{x}=0.$

1.19. $ \frac{d}{dx}\left(cosh\left(x\right)−5x^{7}\right)=sinh\left(x\right)−35x^{6}.$

1.20. $ \frac{d}{dx}\left(\sqrt{3x^{2}}\right)=\sqrt{3}$

1.21. $ \frac{d}{dx}\left(x^{3}+3x−\sqrt{2x}\right)=3x^{2}+3−\frac{1}{\sqrt{2x}}.$

## Version history and licensing

v1.0: initial version created 05/25 by Sara Delgado Garcia as part of a University of St Andrews VIP project.

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