

# Answers: The chain rule

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## Summary

Answers to questions relating to the guide on the chain rule.

These are the answers to [Questions: The chain rule](#).

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

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1.1.  $\frac{d}{dx} \left( \frac{1}{7} \cos(5 + 4x) \right) = -\frac{4}{7} \sin(5 + 4x).$

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1.2.  $\frac{d}{dx} (4 \cos(x^2)) = -8x \sin(x^2).$

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1.3.  $\frac{d}{dx} (e^{x^2+5}) = 2xe^{x^2+5}$

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1.4.  $\frac{d}{dx} (2(\sin(2x))^2) = 8 \sin(2x) \cos(2x).$

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1.5.  $\frac{d}{dx} (e^{\sin(3x)}) = 3 \cos(3x) e^{\sin(3x)}.$

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1.6. Using laws of logarithms, write  $\ln((2 + 4x^{-2})^{-1}) = -\ln(2 + 4x^{-2})$ . Then

$$\frac{d}{dx} (\ln(2 + 4x^{-2})^{-1}) = \frac{8x^{-3}}{2 + 4x^{-2}} = \frac{4}{x^3 + 2x}.$$

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$$1.7. \quad \frac{d}{dx} (e^{5x^4}) = 20x^3 e^{5x^4}$$


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$$1.8. \quad \frac{d}{dx} (e^{2x^{-3}}) = -6x^{-4} e^{2x^{-3}}$$


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$$1.9. \quad \frac{d}{dx} (-5\sqrt{x-2}) = -\frac{5}{2\sqrt{x-2}}$$


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$$1.10. \quad \frac{d}{dx} (\sqrt{(x+3)^2}) = 1 \text{ (for } x \geq -3.)$$


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$$1.11. \quad \frac{d}{dx} (\ln(x^2 + 1)) = \frac{2x}{x^2 + 1}$$


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$$1.12. \quad \frac{d}{dx} (\ln(\cos(x))) = -\tan(x).$$


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$$1.13. \quad \frac{d}{dx} (2 \cos^2(x)) = -4 \cos(x) \sin(x) = -2 \sin(2x).$$


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$$1.14. \quad \frac{d}{dx} (2(x^3 + 5x^2 + 13x - 1)^3) = 6(3x^2 + 10x + 13)(x^3 + 5x^2 + 13x - 1)^2.$$


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$$1.15. \quad \frac{d}{dx} \left( \sqrt{\frac{1}{2x}} \right) = -\frac{1}{4x^2} \left( \frac{1}{2x} \right)^{-1/2}$$


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$$1.16. \quad \frac{d}{dx} (\cos(5x^{-1/2})) = \frac{5}{2} x^{-3/2} \sin(5x^{-1/2}).$$


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$$1.17. \quad \frac{d}{dx} \left( \sin \left( \sqrt{x^2 + 1} \right) \right) = \frac{x \cos(\sqrt{x^2 + 1})}{\sqrt{x^2 + 1}}$$


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$$1.18. \quad \frac{d}{dx} (\sin(e^x)) = e^x \cos(e^x).$$


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$$1.19. \quad \frac{d}{dx} (\cos(e^{-2x} + 5)) = 2e^{-2x} \sin(e^{-2x} + 5).$$


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$$1.20. \quad \frac{d}{dx} (\ln(3x^3 + \sin(x))) = \frac{9x^2 + \cos(x)}{3x^3 + \sin(x)}.$$


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## 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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