

Do Now: Calculus skills review

Differentiate each function.

1. $f(x) = 2x^3 - x^2 + 6$

2. $g(x) = \frac{1}{x^4}$

3. $f(x) = (x - 2)(x + 2)$

4. $g(x) = \frac{2}{(3x)^2}$

5. $h(x) = 6e^x + \sqrt{x^3}$

6. $f(x) = 6 \ln x$

7. $g(x) = \frac{\sin x}{\pi}$

8. $h(x) = \log_3 x$

Use the product, quotient, or chain rule to differentiate each function.

9. $y = 2xe^x$

10. $f(x) = \frac{x^2 - 8}{x + 1}$

11. $g(x) = \frac{x}{x^2 - x + 6}$

12. $y = (3x^3 - x^2 + 4)^4$

13. $y = \ln 2x^2 - 3x$

14. $y = \cos \frac{x^3}{\pi}$

15. $y = \sqrt{\cos 3x}$

Find the equation of the tangent or normal line to the function at the given point.

16. The tangent to $y = 3x^2 - e^x$ at $x = 2$

17. The normal line to $y = \ln(e^{x^2})$

Local extrema: find the value(s) of x for which the function has a local minimum or maximum.

18. $g(x) = x^3 - 4x^2 - 6x + 5$

19. $h(x) = 2 \ln x - x + 4$

Rates of change and motion equations

20. The path of a diver is modeled by the function $s(t) = -4.9t^2 + 4.9t + 10$ where s is the diver's height above the water in meters.

- (a) What is the initial height from which the diver begins her dive?
- (b) What is the initial velocity of the diver?
- (c) What is the maximum height above the water and at what point in time is that height reached?
- (d) When does the diver enter the water?
- (e) At what velocity does she enter the water?

21. The position of an object is given by the function $s(x) = 5 \sin x + x$ over the interval $\{0 \leq x \leq 2\pi\}$

- (a) What is the object's initial velocity?
- (b) At what value of x is the object at its maximum distance from its starting point?
- (c) What is its average velocity over the period from $x = 0$ to when it achieves its maximum distance?
- (d) Over what interval is the object moving in the negative direction?

22. A particle moves along a horizontal line with its displacement given by the function $s(t) = 20t - 100 \ln t$, for $t > 1$.

- (a) Find the velocity of the particle.
- (b) Over what period is the particle moving to the left?
- (c) Show that the velocity of the particle is always increasing.

Exit Note: Calculus skills assessment

1. Given $f(x) = 3\sqrt{x}$. Find $f'(x)$.

2. Given $y = x^2 \cos x$. Find $\frac{dy}{dx}$.

3. Find the equation of the tangent line to $y = 4x^2$ at $x = 1$.

4. Early finishers: Find the values of x for which the function $f(x) = 8x^2 - 24x + 7$ has a local minimum or maximum.