

**Do Now: Calculus skills review**

Pick two problems from each of the following three sections. Answer on lined paper.

**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.