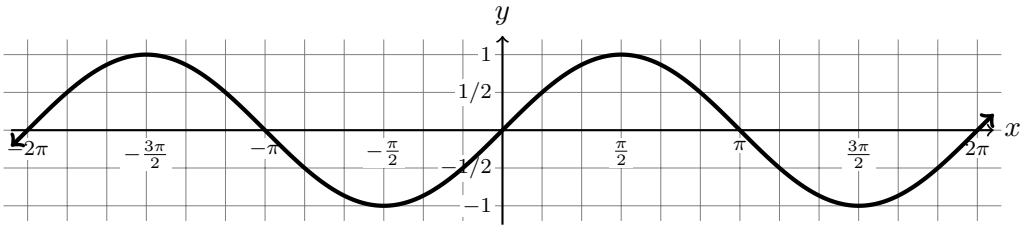
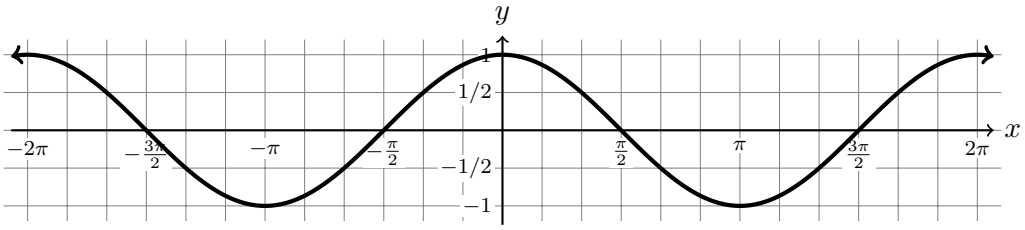
SECTION 3-3: DERIVATIVE RULES

1. (Review from Friday.) On the same set of axes, use the graphs of $f(x) = \sin(x)$ and $g(x) = \cos(x)$ (below) to sketch the graph of their derivatives $f'(x)$ and $g'(x)$.

$f(x) = \sin(x)$



$g(x) = \cos(x)$



2. Use the definition to find the derivative of $H(x) = x^2$.

3. If $f(x) = 10$, what should $f'(x)$ be and why?

4. If $f(x) = c$, where c is some real number, what is $f'(x)$?

5. If $f(x) = x$, what should $f'(x)$ be and why?

6. What about $f(x) = 5x$? Explain.

7. What about $f(x) = 5x + 10$? Explain.

8. In the 3.2 notes on the definition of the derivative, we found that if $f(x) = \sqrt{x+5} = (x+5)^{1/2}$, then its derivative was:

   Use this to determine the derivative of $g(x) = \sqrt{x}$.

9. The Power Rule

10. The Sum (and Difference) Rule

11. The Constant Multiple Rule

12. Apply the rules to find the derivatives of the functions below. Simplify your answers and write with positive exponents.

(a) $f(x) = e^3$

(b) $f(x) = x^{-4}$

(c) $H(x) = 4x^{3/2} + 15$

(d) $j(x) = \dfrac{\sqrt{2}}{2} + x - 8x^{2.3}$

13. Find examples of $f(x)$ and $g(x)$ that demonstrate that the rules below are WRONG.

INCORRECT: If $H(x) = f(x)g(x)$, then $H'(x) = f'(x)g'(x)$.

INCORRECT: If $H(x) = \frac{f(x)}{g(x)}$, then $H'(x) = \frac{f'(x)}{g'(x)}$.

14. Product Rule $\dfrac{d}{dx}\left[f(x)\,g(x)\right] =$

15. Example: Find the derivative of $f(x) = x^2 \sin(x)$

16. Quotient Rule: $\dfrac{d}{dx}\left[\dfrac{f(x)}{g(x)}\right] =$

17. Example: Use the Quotient Rule to find the derivative of $g(t) = \frac{\cos(t)}{1-2t}$.

18. Notation

19. Higher Order Derivatives