You’ve done some matching of anti-derivatives with the function. Now see if you can work backwards and come up with the anti-derivatives for the following functions.

Once you come up with a potential anti-derivative, check to see if it is truly an antiderivative.

**Example: Find the antiderivative of** $\sin(x)$.

*My thought process:*

Brain 1: “What function, when I take the derivative of it, gives me $\sin(x)$?”

Brain 2: “Obviously it is $\cos(x)$. Sine and cosine are derivatives of each other. Duh.”

Brain 1: “Hm. It sounds plausible. Let’s check to see if it works. So $\frac{d}{dx} \cos(x) = -\sin(x)$. Brain 2, you are WRONG. We aren’t getting $\sin(x)$.”

Brain 2: “Well, since we are off by a negative sign, what about $-\cos(x)$ being the antiderivative, instead of $\cos(x)$.”

Brain 1: “Okay, let’s try it out. So $\frac{d}{dx} -\cos(x) = \sin(x)$. Hooray!”

Brain 2: “I am so smart, SMRT.”

**Example: Find the antiderivative of** $x^2$.

*My thought process:*

Brain 1: “What function, when I take the derivative of it, gives me $x^2$?”

Brain 2: “Well, what about $2x$?”

Brain 1: “Hm. It sounds plausible. Let’s check to see if it works. So $\frac{d}{dx} 2x = 2$. Brain 2, you are WRONG. We aren’t getting $x^2$. You gave me the derivative of $x^2$ … not the antiderivative.”

Brain 2: “Wait. I think I’m getting it. When we take derivatives of things like $x^{28}$, we get a lower degree… In this case, we’d get $28x^{27}$. So for if we want to get the antiderivative of $x^2$, wouldn’t we want to try $x^3$? Derivatives give us one lower degree, so wouldn’t we want one higher degree for antiderivatives?”

Brain 1: “Mayhaps! So $\frac{d}{dx} x^3 = 3x^2$. DRAT! SO CLOSE. We are getting $3x^2$. We need to get $x^3$.”

Brain 2: “We well want to get rid of the constant 3, so why don’t we try the function $\frac{1}{3}x^3$? That way the 3 and $\frac{1}{3}$ cancel each other out.”

Brain 1: “Okay, lemme check. $\frac{d}{dx} \frac{1}{3}x^3 = \frac{1}{3}(3x^2) = x^2$. You did it! You’re the best.”

Brain 2: “I know.”
1. Find the antiderivative of $3$.

   Check to make sure that you are right: $\frac{d}{dx}[ ] = 3$

2. Find the antiderivative of $-17$.

   Check to make sure that you are right: $\frac{d}{dx}[ ] = -17$

3. Find the antiderivative of $x$.

   Check to make sure that you are right: $\frac{d}{dx}[ ] = x$

4. Find the antiderivative of $x^2$.

   Check to make sure that you are right: $\frac{d}{dx}[ ] = x^2$

5. Find the antiderivative of $x^3$.

   Check to make sure that you are right: $\frac{d}{dx}[ ] = x^3$

6. Find the antiderivative of $x^4$.

   Check to make sure that you are right: $\frac{d}{dx}[ ] = x^4$
7. Find the antiderivative of $x^{21}$.

Check to make sure that you are right: $\frac{d}{dx}[x^{21}] = x^{21}$

8. Find the antiderivative of $x^{\frac{1}{2}}$.

Check to make sure that you are right: $\frac{d}{dx}[x^{\frac{1}{2}}] = x^{\frac{1}{2}}$

9. Find the antiderivative of $x^{-4/5}$.

Check to make sure that you are right: $\frac{d}{dx}[x^{-4/5}] = x^{-4/5}$

10. Find the antiderivative of $\sin(2x)$.

Check to make sure that you are right: $\frac{d}{dx}[\sin(2x)] = \sin(2x)$

11. Find the antiderivative of $\sin(3x)$.

Check to make sure that you are right: $\frac{d}{dx}[\sin(3x)] = \sin(3x)$

12. Find the antiderivative of $\sin(\sqrt{2}x)$.

Check to make sure that you are right: $\frac{d}{dx}[\sin(\sqrt{2}x)] = \sin(\sqrt{2}x)$
13. Find the antiderivative of $\cos(\pi x)$.

Check to make sure that you are right: $\frac{d}{dx} [\cos(\pi x)] = \cos(\pi x)$

14. Find the antiderivative of $3x^4 + x^2$.

Check to make sure that you are right: $\frac{d}{dx} [3x^4 + x^2] = 3x^4 + x^2$

15. Find the antiderivative of $2x + 5\sin(x)$.

Check to make sure that you are right: $\frac{d}{dx} [2x + 5\sin(x)] = 2x + 5\sin(x)$

16. Find the antiderivative of $-5\sec^2(x)$.

Check to make sure that you are right: $\frac{d}{dx} [-5\sec^2(x)] = -5\sec^2(x)$

17. Find the antiderivative of $\cos^2(x)\sin(x)$.

Check to make sure that you are right: $\frac{d}{dx} [\cos^2(x)\sin(x)] = \cos^2(x)\sin(x)$

18. Find the antiderivative of $5x\sin(x^2)$.

Check to make sure that you are right: $\frac{d}{dx} [5x\sin(x^2)] = 5x\sin(x^2)$