This activity failed BIG TIME, twice. Better replacement: "Find a function $F(x)$ such that $F'(x) = x^5$. Then find another one. What do you think all of them look like? Same for x^{-3}, x^{-1}, $\cos x$, $\sin x$. e^x? e^{5x}? e^{x^2}? (Spoiler alert: the last one is impossible! That's why antidifferentiation is so difficult.)" Then end with 5-min mini-lecture about the rules of antiderivatives.

1. Consider the following twelve functions:

$$
\begin{aligned}
f_1(x) &= \frac{5 - 3x + x^7}{x} & \qquad g_1(x) &= x\sin(x^2) \\
f_2(x) &= \frac{x^{84} - 7x^{27}}{85} & g_2(x) &= e^x + x^3 \\
f_3(x) &= \cos(x^2) & g_3(x) &= \frac{1}{\ln x} \\
f_4(x) &= 3\cos x + \sec^2 x & g_4(x) &= \frac{7}{\sqrt{x}} - 17\sqrt[5]{x} \\
f_5(x) &= (x^2+4)(x - x^3) & g_5(x) &= 11x^2\sqrt{x} + 13 \\
f_6(x) &= 5\sin x - 7^x & g_6(x) &= xe^x
\end{aligned}
$$

   It turns out that you can compute the antiderivatives of eight of these functions using our rules to date, possibly along with some algebra. Two of the other functions can only be computed using methods we haven't learned yet, and the remaining two actually do not have antiderivatives expressible in terms of ordinary functions you have seen.

   (a) Identify the four whose antiderivatives you can't compute yet, and in your groups, discuss why our current rules do not suffice to compute them.

   (b) Compute the other eight general antiderivatives. **DO NOT SIMPLIFY** your answers.

2. (a) Find the most general function $h(x)$ such that $h''(x) = e^x + \sin x$.

   (b) Find $h(x)$ such that $h''(x) = e^x + \sin x$, $h'(0) = 17$, and $h(0) = 31$.