30. Solve the following initial value problems:
    (a) $y'' - 3y' - 10y = 0$. First, $y(0) = 1$, $y'(0) = 0$. Next, $y(0) = 0$, $y'(0) = 1$;
    (b) $6y'' - 5y' + y = 0$. First, $y(0) = 4$, $y'(0) = 0$. Next: $y(0) = 0$, $y'(0) = 0$;
    (c) $y'' + 3y' = 0$, $y(0) = -2$, $y'(0) = 3$;
    (d) $6y'' - 7y' + 2y = 0$, $y(0) = 0$, $y'(0) = 1$;
    (e) $2y'' - 3y' + y = 0$, $y(0) = 2$, $y'(0) = \frac{1}{2}$.
31. If $b^2 - 4ac > 0$, solve the IVP $ay'' + by' + cy = 0$, $y(t_0) = y_0$, $y'(t_0) = y_0'$.
32. Consider the equation $y'' = y$.
    (a) Sketch the solutions c with $y(0) = 1$ and $y'(0) = 0$ and s with $y(0) = 0$ and $y'(0) = 1$.
    (b) Show that $c^2(t) - s^2(t) = 1$ for all t. Also, prove that $c' = s$ and $s' = c$.
    (c) Draw the Gateway Arch $y(x) = -127.7c(\frac{x}{127.7}) + 757.7$. How high is it? How long is it's base?
33. Find the Wronskian of the given pair of functions:
    (a) e^{-2t} and $t\mathrm{e}^{-2t}$; (b) e^{-2t} and $\frac{3}{5}\mathrm{e}^{-2t}$; (c) $\cos t$ and $\sin t$;
    (d) $\cosh t$ and $\sinh t$; (e) t^n and t^m; (f) t^n and mt^n;
    (g) t and $t\mathrm{e}^t$; (h) $\cos^2 t$ and $1 + \cos(2t)$.
34. If the Wronskian of y_1 and y_2 is $3\mathrm{e}^{4t}$ and if $y_1(t) = \mathrm{e}^{2t}$, find y_2.
35. If $b^2 - 4ac > 0$, calculate the Wronskian of any two solutions of $ay'' + by' + cy = 0$.
36. Consider the equation $y'' + q(t)y = 0$.
    (a) If $q(t) \equiv -1$, find two solutions such that the Wronskian is always 1.
    (b) If $q(t) \equiv 1$, find two solutions such that the Wronskian is always 1.
    (c) If q is any continuous function, show that the Wronskian of any two solutions is independent of the time. Calculate the Wronskian.
37. For the equation $(p(t)y')' + q(t)y = 0$, where p is differentiable and never zero and q is continuous, calculate the Wronskian of any two solutions.