33.32 Water is pumped from a stationary open basin to the top of a water feature. The outlet is a free flow located $10ft$ above the surface of the basin and is also open to the atmostphere. If the pump selected is capable of supplying $18ft$ of head, what is the maximum velocity at the outlet? Neglect losses.

A. $23\frac{ft}{s}$

B. $34\frac{ft}{s}$

C. $42\frac{ft}{s}$

D. $58\frac{ft}{s}$

Start with the modified Bernoulli Equation for head added by a pump, neglecting losses to allow for the maximum velocity. Consider the basin as State 1 and the outlet at the top of the water feature as State 2.

$$h_A = \frac{P_2 - P_1}{\gamma} + \frac{v_2^2 - v_1^2}{2g} + z_2 - z_1 + h_f$$

$$h_f = 0$$

Both the basin and the outlet are open to the atmosphere, so $P_1 = P_2$ and there is no difference in static pressure.

$$P_2 - P_1 = 0$$

The head added by the pump exceeds the height difference that must be overcome from the basin to the outlet, and the excess pressure will drive the maximum velocity at State 2, v_2. The velocity at State 1, v_1, is zero since the water in the basin is stationary. Calculate v_2.

$$18ft = \frac{v_2^2}{2g} + (10ft - 0ft)$$

$$v_2 = \sqrt{(8ft)\,(2)\left(32.2\frac{ft}{s^2}\right)} = 22.7\frac{ft}{s}$$

Answer A