Definite Integration Formulas

For any real constants $a$, $b$, and $c$:

\[
\begin{array}{l}
\int_a^b c \, dx = c(b - a) \\
\int_a^b x \, dx = \frac{b^2}{2} - \frac{a^2}{2} \\
\int_a^b x^2 \, dx = \frac{b^3}{3} - \frac{a^3}{3}
\end{array}
\]

We also have the following **linearity property** of integrals, which can be used to combine the above formulas:

For continuous functions $f$ and $g$ on $[a, b]$ and constants $\alpha$ and $\beta$,

\[
\int_a^b (\alpha f(x) + \beta g(x)) \, dx = \alpha \int_a^b f(x) \, dx + \beta \int_a^b g(x) \, dx.
\]

From this linearity property we see that, for example,

\[
\int_a^b (3x^2 - 12x + 2) \, dx = 3 \int_a^b x^2 \, dx - 12 \int_a^b x \, dx + \int_a^b 2 \, dx,
\]

so that the formulas in the table above can be used to complete the evaluation of the definite integral.