FAR BEYOND

MAT122

Area Between the Curves - Application

Stony Brook University

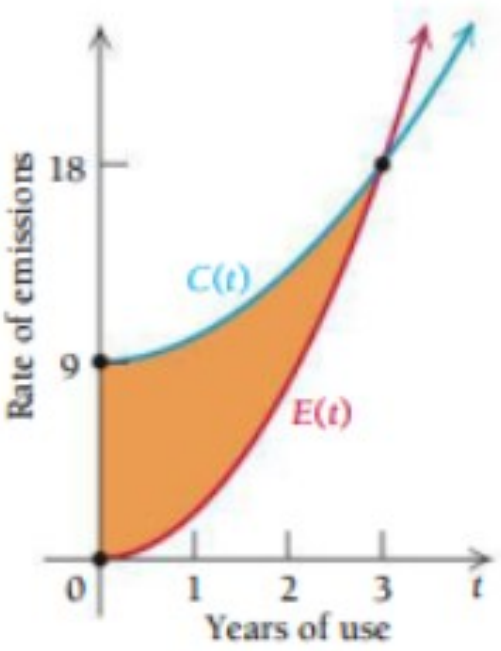
Area Between Two Curves – Application

ex. A student develops an engine believed to meet state emission standards.

The new engine's emission rate is given by $E(t) = 2t^2$

where E is in billions of pollution particles per year and t is time in years.

The emission rate of a conventional engine is given by $C(t) = 9 + t^2$.



At what time will the emission rates be the same?

$$E(t) = C(t)$$
$$2t^2 = 9 + t^2$$
$$t^2 = 9$$
$$t^2 - 9 = 0$$
$$(t+3)(t-3) = 0 \Rightarrow t = 3 \text{ or } t = -3$$

invalid solution

$$\int_a^b (Y_T - Y_B)\,dx$$

What reduction in emissions results from the use of the student's engine over first 3 years?

$$\int_0^3 [(9 + t^2) - 2t^2]\,dt$$
$$= \int_0^3 (9 - t^2)\,dt$$
$$= \left(9t - \frac{t^3}{3}\right)\Big|_0^3 = \left(9 \cdot 3 - \frac{3^3}{3}\right) = 27 - 9 = \boxed{18}$$

Interpretation:
Over 3 years, student's engine reduces emissions by 18 billion pollution particles.