Definition 7.2.1. *Suppose x represents a possible numerical outcome of an experiment and that $[c, d]$ represents an interval of possible outcomes of the experiment. A ______________________________, $y = f(x)$, is a function that helps us determine the probability that an outcome of x will occur in the interval $[c, d]$*

This functions must satisfy the following properties:

(1)

(2)

(3) When $[c, d]$ is an interval of real numbers then the probability of outcome x during the interval $[c, d]$ is

Example 7.2.1. *The shelf life (in years) of a certain brand of clock radio is a continuous random variable with probability density function*

$$f(x) = \begin{cases} \frac{3}{(x+3)^2} & \text{if } x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

What is the probability that a randomly selected clock radio has a shelf life from 2 to 6 years?

Example 7.2.2. *The shelf life (in years) of a certain brand of clock radio is a continuous random variable with probability density function*

$$f(x) = \begin{cases} \frac{4}{(x+4)^2} & \text{if } x \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

What is the probability that a randomly selected clock radio has a shelf life of 1 year or less?

Example 7.2.3. *A manufacturer guarantees a product for 5 years. The time to failure of that product after it is sold is given by the probability density function*

$$f(t) = \begin{cases} 0.03e^{-0.03t} & \text{if } t \geq 0 \\ 0 & \text{otherwise} \end{cases}$$

where t is time in years. What is the probability that a buyer chosen at random will have a product failure during the warranty period?

Example 7.2.4. *The time to failure of a product after it is sold is given by the probability density function*

$$f(t) = \begin{cases} 0.15e^{-0.15t} & \textit{if } t \geq 0 \\ 0 & \textit{otherwise} \end{cases}$$

where t is time in months. What is the probability that a buyer chosen at random will have a product failure during the second year after purchase?

Income Stream

Definition 7.2.2. *In many applications it is assumed that income is received in a ________________________ rather than in discrete points of time. The rate of change of the continuous income stream is called the ________________________.*

Theorem 7.2.1. *If $f(t)$ is the rate of flow of a continuous income stream, then the* **total income** *produced from the time $t = a$ to $t = b$ is*

Example 7.2.5. *Find the total income (in thousands of dollars) produced by a vending machine in its first 3 years of operation if the rate of the flow of its continuous income stream is given by $f(t) = 6\mathrm{e}^{0.05t}$, where t is the time in years since the installation of the machine and $f(t)$ is in thousands of dollars.*

(1) $120(\mathrm{e}^{0.15} - \mathrm{e}^{0.05})$
(2) $120\mathrm{e}^{0.15} - 1$
(3) $120\mathrm{e}^{0.15}$
(4) $120(\mathrm{e}^{0.15} - 1)$
(5) none of these

Definition 7.2.3. *Suppose an income with a rate of flow $f(t)$ is invested in a continuously compounded account with an interest rate r. The* ____________________________*,* FV*, at the end of* T *years later is given by*

Consumers' and Producers' Surplus

Definition 7.2.4. *Suppose $p = D(x)$ is a price-demand equation for a product. Then the* ______________________________________*,* CS*, at a price level of* $\overline{p}$

where $\overline{x}$ is the demand at price $\overline{p}$.

Definition 7.2.5. *Suppose $p = S(x)$ is a supply-supply equation for a product. Then the* ______________________________________*,* PS*, at a price level of* $\overline{p}$

where $\overline{x}$ is the demand at price $\overline{p}$.

Definition 7.2.6. *The point(s) where the price-demand equation and the price-supply*

equation intersect is called the ______________________________________ *and*

____

Example 7.2.6. *The price-demand equation for a produce os* $p = D(x) = 13 - \frac{2}{3}x$*. If the equilibrium price is* \$7*, what is the consumer's surplus in dollars?*

Example 7.2.7. *The price-demand equation for a produce os* $p = D(x) = \frac{21}{3x+4}$*. If the equilibrium quantity is 1 unit, what is the consumer surplus in dollars?*

Example 7.2.8. *The price-supply equation for a produce os* $p = S(x) = 2x^2 + x + 5$. *If the equilibrium price is* \$15, *what is the producer's surplus in dollars?*

Example 7.2.9. *For a certain product, the price-demand and price-supply equations are* $p = D(x) = 20 - 3x^2$ *and* $p = S(x) = 3x + 2$ *respectively. Find the consumer surplus at the equilibrium price level.*

(1) 6
(2) 12
(3) 16
(4) 48
(5) none of these

Homework: 7.2 p. 467 # 7, 11, 15, 19, 37, 41, 47 work e-grade practice at least 2 times.