

1. Problem

The rate at which an office building consumes energy (in kilowatt-hours(KWh) per week) is approximated by $f(t) = 31.164e^{0.7261t}$, where t is in weeks since February 2, 2020. Energy consumption costs 9 cents per kilowatt-hour.

Use three digit accuracy in all computations.

Select each of the true statements from the following:

- (a) The rate at which energy is consumed 3 weeks after February 2, 2020 is $f(2)$.
- (b) The rate at which energy is consumed 5 weeks after February 2, 2020 is $f(5)$.
- (c) The total amount of energy used by the office building during the 2 weeks after February 2, 2020 is $\int_0^2 f(t)dt$.
- (d) An antiderivative of $f(t) = 31.164e^{0.7261t}$ is $F(t) = 31.164e^{0.7261t}$
- (e) $\int_0^2 f(t)dt = 42.92e^{0.7261(2)} - 42.92e^{0.7261(0)}$
- (f) The total amount of energy used by the office building during the 5 weeks after February 2, 2020 is 1576.513 KWh.
- (g) The energy cost for the office building during the 3 weeks after February 2, 2020 is \$30.25.
- (h) All of the above statements are false.

Solution

- (a) False. The rate at which energy is consumed 3 weeks after February 2, 2020 is $f(3) = 275.218$ KWh per week.
- (b) True. The rate at which energy is consumed 5 weeks after February 2, 2020 is $f(5) = 1175.87$ KWh per week.
- (c) True. The total amount of energy used by the office building during the 2 weeks after February 2, 2020 is

$$\int_0^2 31.164e^{0.7261t} dt = \frac{31.164}{0.7261} e^{0.7261(2)} - \frac{31.164}{0.7261} e^{0.7261(0)} = 140.455$$

- (d) False. An antiderivative of $f(t) = 31.164e^{0.7261t}$ is $F(t) = \frac{31.164}{0.7261} e^{0.7261t} = 42.92e^{0.7261t}$
- (e) True.

$$\int_0^2 f(t)dt = \int_0^2 31.164e^{0.7261t} dt = \frac{31.164}{0.7261} e^{0.7261(2)} - \frac{31.164}{0.7261} e^{0.7261(0)}$$

- (f) True. The total amount of energy used by the office building during the 5 weeks after February 2, 2020 is

$$\int_0^5 31.164e^{0.7261t} dt = \frac{31.164}{0.7261} e^{0.7261(5)} - \frac{31.164}{0.7261} e^{0.7261(0)} = 1576.513 \text{ KWh}$$

- (g) True. The total amount of energy used by the office building during the 3 weeks after February 2, 2020 is

$$\int_0^3 31.164e^{0.7261t} dt = \frac{31.164}{0.7261} e^{0.7261(3)} - \frac{31.164}{0.7261} e^{0.7261(0)} = 336.116 \text{ KWh}$$

To find the energy cost during this period of time we simply multiply this total amount of energy by 0.09 dollars per KWh to get \$30.25

- (h) False.