

### 1. Problem

The rate at which an office building consumes energy (in kilowatt-hours(KWh) per week) is approximated by  $f(t) = 31.461e^{0.7621t}$ , where  $t$  is in weeks since January 4, 2020. Energy consumption costs 18 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 January 4, 2020 is  $f(3)$ .
- (b) The rate at which energy is consumed 5 weeks after January 4, 2020 is  $f(18)$ .
- (c) The total amount of energy used by the office building during the 3 weeks after January 4, 2020 is  $\int_0^4 f(t)dt$ .
- (d) An antiderivative of  $f(t) = 31.461e^{0.7621t}$  is  $F(t) = 41.282e^{0.7621t}$
- (e)  $\int_0^5 f(t)dt = 41.282e^{0.7621(5)} - 41.282e^{0.7621(0)}$
- (f) The total amount of energy used by the office building during the 4 weeks after January 4, 2020 is 870.29 KWh.
- (g) The energy cost for the office building during the 2 weeks after January 4, 2020 is \$26.69.
- (h) All of the above statements are false.

### Solution

- (a) True. The rate at which energy is consumed 3 weeks after January 4, 2020 is  $f(3) = 309.528$  KWh per week.
- (b) False. The rate at which energy is consumed 5 weeks after January 4, 2020 is  $f(5) = 1421.188$  KWh per week.
- (c) False. The total amount of energy used by the office building during the 3 weeks after January 4, 2020 is

$$\int_0^3 31.461e^{0.7621t} dt = \frac{31.461}{0.7621} e^{0.7621(3)} - \frac{31.461}{0.7621} e^{0.7621(0)} = 364.869$$

- (d) True. An antiderivative of  $f(t) = 31.461e^{0.7621t}$  is  $F(t) = \frac{31.461}{0.7621} e^{0.7621t} = 41.282e^{0.7621t}$
- (e) True.

$$\int_0^5 f(t)dt = \int_0^5 31.461e^{0.7621t} dt = \frac{31.461}{0.7621} e^{0.7621(5)} - \frac{31.461}{0.7621} e^{0.7621(0)}$$

- (f) False. The total amount of energy used by the office building during the 4 weeks after January 4, 2020 is

$$\int_0^4 31.461e^{0.7621t} dt = \frac{31.461}{0.7621} e^{0.7621(4)} - \frac{31.461}{0.7621} e^{0.7621(0)} = 829.008 \text{ KWh}$$

- (g) True. The total amount of energy used by the office building during the 2 weeks after January 4, 2020 is

$$\int_0^2 31.461e^{0.7621t} dt = \frac{31.461}{0.7621} e^{0.7621(2)} - \frac{31.461}{0.7621} e^{0.7621(0)} = 148.263 \text{ KWh}$$

To find the energy cost during this period of time we simply multiply this total amount of energy by 0.18 dollars per KWh to get \$26.69

- (h) False.