Class Discussion: 24 January 2019

Rates of change

32. Figure 1.7 shows the fuel consumption (in miles per gallon, mpg) of a car traveling at various speeds (in mph).

(a) How much gas is used on a 300-mile trip at 40 mph?

(b) How much gas is saved by traveling 60 mph instead of 70 mph on a 200-mile trip?

(c) According to this graph, what is the most fuel-efficient speed to travel? Explain.

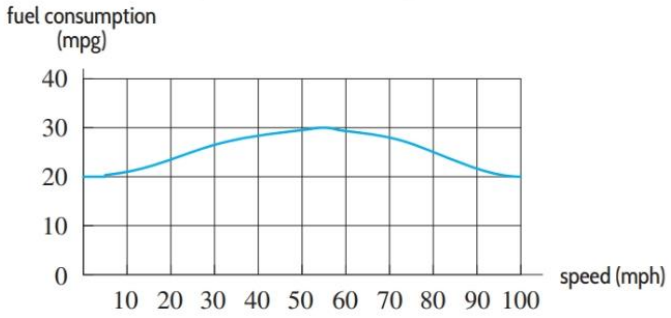

Figure 1.7

34. Figure 1.8 shows the mass of water in air, in grams of water per kilogram of air, as a function of air temperature in °C, for two different levels of relative humidity.

(a) Find the mass of water in 1 kg of air at 30°C if the relative humidity is

(a) 100% **(b)** 50% **(c)** 75%

(b) How much water is in a room containing 300 kg of air if the relative humidity is 50% and the temperature is 20°C?

(c) The density of air is approximately 1.2 kg/m^3. If the relative humidity in your classroom is 50% and the temperature is 20°C, estimate the amount of water in the air.

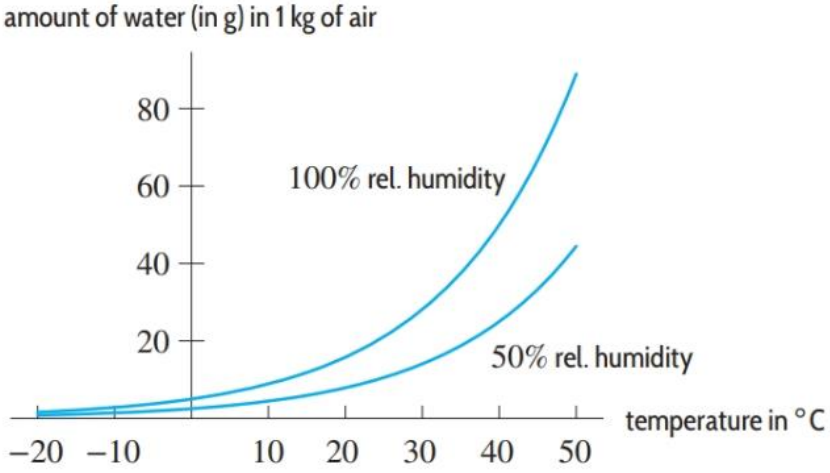

Figure 1.8

8. Table 1.12 gives the populations of two cities (in thousands) over a 17-year period.

(a) Find the average rate of change of each population on the following intervals:

(i) 1996 to 2006 (ii) 1996 to 2013
(iii) 2001 to 2013

(b) What do you notice about the average rate of change of each population? Explain what the average rate of change tells you about each population.

Table 1.12

Year	1996	1998	2001	2006	2013
P_1	42	46	52	62	76
P_2	82	80	77	72	65

Exercises 10–14 use Figure 1.17.

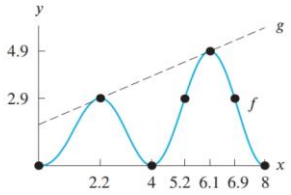

Figure 1.17

10. Find the average rate of change of f for $2.2 \le x \le 6.1$.

11. Give two different intervals on which $\Delta f(x)/\Delta x = 0$.

12. What is the average rate of change of g between $x = 2.2$ and $x = 6.1$?

13. What is the relation between the average rate of change of f and the average rate of change of g between $x = 2.2$ and $x = 6.1$?

14. Is the rate of change of f positive or negative on the following intervals?

17. Figure 1.18 shows the percent of the side of the moon toward the earth illuminated by the sun at different times during the year 2008. Use the figure to answer the following questions.

(a) Give the coordinates of the points A, B, C, D, E.
(b) Plot the point $F = (15, 60)$ and $G = (60, 15)$. Which point is on the graph?
(c) During which time intervals is the function increasing?
(d) During which time intervals is the function decreasing?

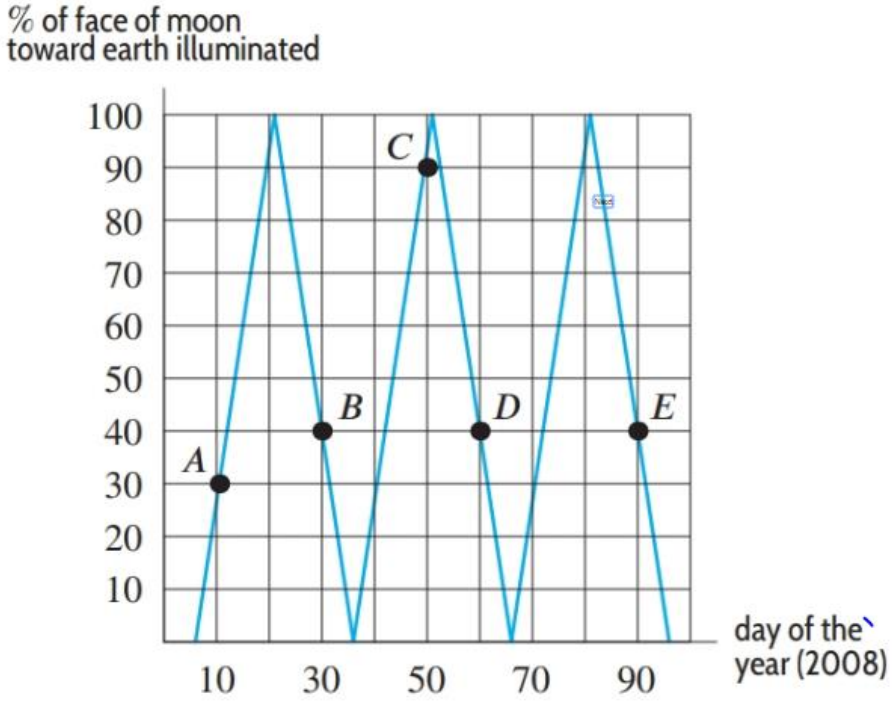

Figure 1.18: Moon phases