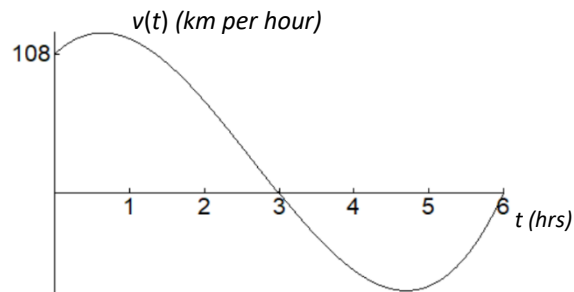


Luke Takes a Trip (Section 5.3)

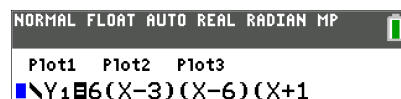
The figure shows the velocity of Luke's trip from Beggar's Canyon. Positive velocities take him **away** from Beggar's Canyon and negative velocities take him **toward** Beggar's Canyon.



The formula of the velocity, in km/hr, is given by $v(t) = 6(t-3)(t-6)(t+1) = 6t^3 - 48t^2 + 54t + 108$, where t is in hours. Recall $v(t) = s'(t)$, where $s(t)$ is his position from Beggar's Canyon.

Complete the blanks. Use the word bank where provided.

- a. How many km is Luke away from Beggar's Canyon at the end of the 6 hours?



At the end of 6 hours Luke is a distance of 108 km from Beggar's Canyon.

Represent this as an integral:

$$\int_0^6 (s'(t)) dx = 108$$



- b. When is Luke farthest from Beggar's Canyon? How far away was he at that time?

At $t = \underline{3}$ hours Luke is the maximum distance of 256.5 km from Beggar's Canyon. When the velocity changes from positive to negative Luke turns direction and he moves toward the canyon.

Represent this as an integral:

$$\int_0^3 (s'(t)) dx = 256.5$$



- c. At the start of the trip, Luke had set his "trip odometer," which records km traveled, to 0 km. Report the total number of kilometers the odometer reads at the end of the trip, i.e., after 6 hours. 405 km. The following graph of Luke's speed may be helpful.

Represent this as an integral:

Method 1: The total odometer distance is the area under the speed $y = |v(t)|$.

$$\int_0^6 (|s'(t)|) dx = 405$$



Method 2:

The area under the velocity $y = v(t)$ from $t = 0$ to $t = 3$ is the distance Luke moved **away** from Beggar's Canyon, 256.5 km. The area under the velocity $y = v(t)$ from $t = 3$ to $t = 6$ is the distance Luke moved **toward** Beggar's Canyon, 148.5 km.

Luke initially travels away from Beggar's Canyon. He slows down and at $t = 3$ he stops. At this point he is the farthest distance (256.5 km) away. He turns in the opposite direction and travels 148.5 km toward Beggar's Canyon for 3 more hours. At $t = 6$ his *total displacement* is $256.5 - 148.5 = 108$ km away from Beggar's Canyon, but his *odometer* reads a *total distance* traveled of $256.5 + 148.5 = 405$ km.

