The Tachymeter and the Hyperbola

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A tachymeter (ta kim‘ i ter) is a scale on certain chronograph watches that enables one to calculate speed, where “speed” is the amount of work done in one hour. The work can range from covering a certain distance to manufacturing a number of items. With x as the number of seconds/task and using the equation $y = 3600/x$, some convenient values of y are placed around the watch dial as shown in figure 1. The graph is shown in figure 2.

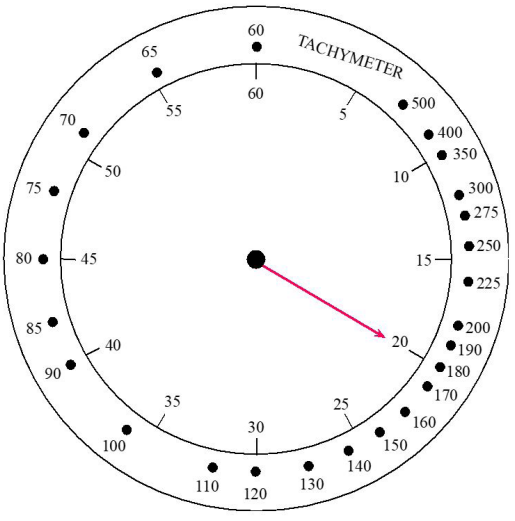

Figure 1. Tachymeter

Keywords: Rate, Speed, Work, Time

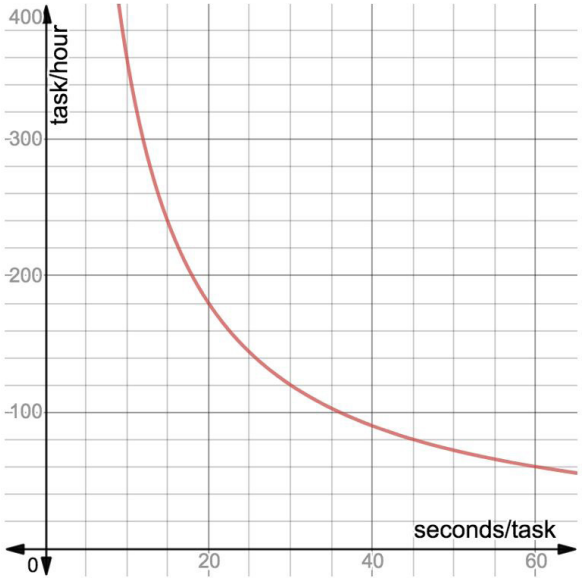

Figure 2. Graph of $y = 3600/x$

In the equation $y = 3600/x$, the units for the numerator are "seconds per hour," and the units for the denominator are "seconds per task." For example, the denominator may be "seconds per kilometre" or "seconds per light bulb produced." Consequently, the units for y, the numbers on the tachymeter, are "task per hour." Conveniently, the x value is given by the position of the second hand, assuming of course that the tip of the second hand started at the top of the watch. For example, when $x = 20$, $y = 180$. If it takes 20 seconds for a racecar to travel one kilometre, then the car is traveling at a speed of 180 kilometres per hour; (3600 seconds/hour)/(20 seconds/kilometre) = 180 kilometres/hour. If it takes 20 seconds to produce one light bulb, then 180 light bulbs are produced in an hour.

A nice feature of the hyperbola is that for every point (a, b) there is a point (b, a). So, in the example since the point (20, 180) is on the curve, so is (180, 20), which means that if it takes 180 seconds to cover 1 kilometre, the speed is 20 kilometres per hour.

Since the equation $y = 3600/x$ implies $x = 3600/y$, if we know the value of y, we can find the value of x. For example, if we know we are going 80 kilometres per hour, we can find 80 on the tachymeter and see 80 corresponds to 45 seconds/kilometre, so we know we travel one kilometre in 45 seconds.

The shape of the hyperbola tells us that the more seconds it takes to do something, the slower the speed, something that is intuitively obvious. The tachymeter basically converts from seconds per task to a speed of task per hour, and that is achieved with a simple, beautiful hyperbola.

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