t (hours)	0	2	5	7	8
E(t) (hundreds of pounds)	0	4	13	21	23

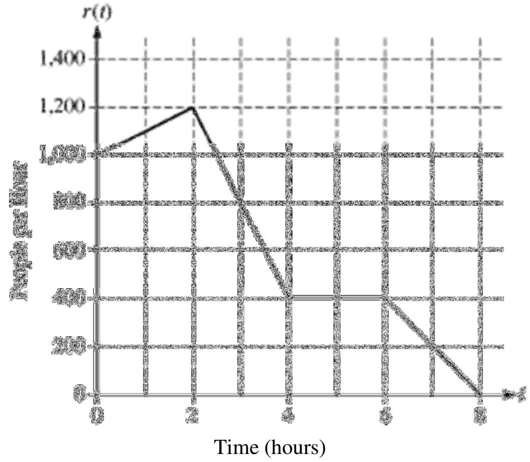
Sand is being dumped into a box between noon ($t = 0$) and 8 PM ($t = 8$). The amount of sand in the box t hours after noon is modeled by a differentiable function E for $0 \le t \le 8$. Values of E(t), in hundreds of pounds, at various times t are shown in the table above.

a. Use the data in the table to approximate the rate, in hundreds of pounds per hour, at which sand is being dumped at time $t = 6$. Show the computations that lead to your answer.

b. Use a trapezoidal sum with the four subintervals given by the table to approximate the value of $\frac{1}{8}\int_0^8 E(t)\,dt$. Using correct units, explain the meaning of $\frac{1}{8}\int_0^8 E(t)\,dt$ in terms of the number of pounds.

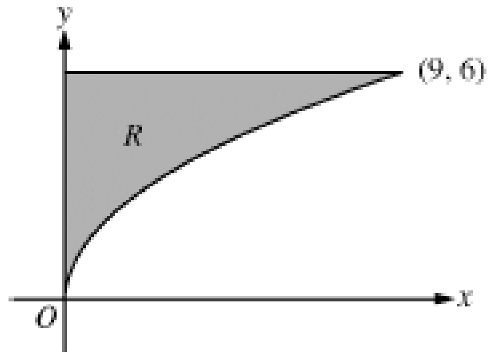
c. At 8 PM, removal of the sand begins. The removal rate is given by the function P, where $P(t) = t^3 - 30t^2 + 298t - 976$ hundreds of pounds per hour for $8 \le t \le 12$. According to the model, how many pounds had not yet been removed by midnight ($t = 12$) ?

d. According to the model from part (c), at what time was the sand being removed most quickly? Justify your answer.



There are 700 people in line for a ride at Cedar Pointe when it starts operation. Once operation starts, the ride takes on passengers until the park closes 8 hours later. While there is a line, people move onto the ride at a rate of 800 people per hour. The graph above shows the rate, r(t), at which people arrive at the ride throughout the day. Time t is measured in hours the time the ride begins operation.

a.	How many people arrive at the ride between t = 0 and t = 3 ? Show the computations that lead to your answer.
b.	Is the number of people waiting in line to get on the ride increasing or decreasing between t = 2 and t = 3 ? Justify your answer.
c.	At what time is the line for the ride longest? How many people are in line at that time? Justify your answers.
d.	Write, but do not solve, an equation involving an integral expression of r whose solution gives the earliest time t at which there is no longer a line for the ride.



Let R be the region in the first quadrant bounded by the graph of $y = 2\sqrt{x}$, the horizontal line y = 6, and the y-axis, as shown in the figure above.

a.	Find the area of R.
b.	Write, but do not evaluate, an integral expression that gives the volume of the solid generated when R is rotated about the horizontal line y = 7.
c.	Region R is the base of a solid. For each y, where $0 \le y \le 6$, the cross-section of the solid taken perpendicular to the y-axis is a rectangle whose height is 3 times the length of its base in region R. Write, but do not evaluate, an integral expression that gives the volume of the solid.

Solutions to the differential equation $\frac{dy}{dx} = xy^3$ also satisfy $\frac{d^2y}{dx^2} = y^3(1 + 3x^2y^2)$. Let y = f(x) be a particular solution to the differential equation $\frac{dy}{dx} = xy^3$ with f(1) = 2.

a. Write an equation for the line tangent to the graph of y = f(x) at x = 1.

b. Use the tangent line equation from part (a) to approximate f(1.1). Given that f(x) > 0 for 1 < x < 1.1, is the approximation for f(1.1) greater than or less than f(1.1) ? Explain your reasoning.

c. Find the particular solution y = f(x) with initial condition f(1) = 2.