Outline

1. Distance, velocity and acceleration
2. Area under a graph
3. Left and right hand Riemann sums.

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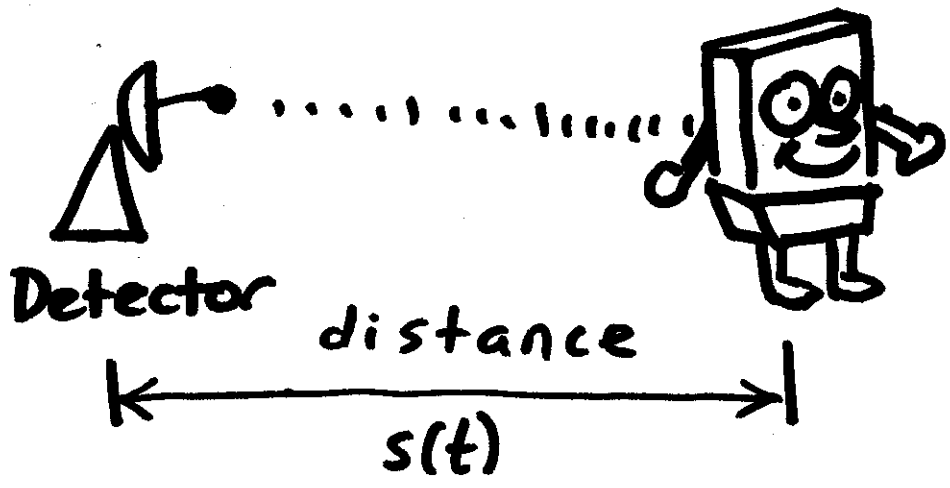
HW due tomorrow.

1. Distance, Velocity and Acceleration

Quantity	Function Notation	Units
Distance.	$s(t)$	m.
↓ diff. ↑ anti-deriv.		
Velocity	$s'(t)$	m/s.
↓ diff. ↑ anti-deriv.		
Acceleration	$s''(t)$	$m/s^2 = \frac{m/s}{s}$



Example

Observation deck: 450 m above ground.

Drop a camera at time $t = 0$ s.

(a) How long until the camera hits the ground?

(b) What is the speed when it hits?

- Speed = | velocity |.

Solution

- Acceleration: $-9.8\ m/s^2$
- Initial velocity: $0\ m/s$.

$$s''(t) = -9.8$$

↓ anti-derivative.

$$s'(t) = -9.8t + C$$

- Have: $s'(0) = 0$

$$0 = -9.8(0) + C$$

$$0 = C.$$

$$s'(t) = -9.8t.$$

↓ anti-derivative

$$s(t) = -\frac{9.8t^2}{2} + C$$

- Have: $s(0) = 450\ m$

$$450 = -\frac{9.8}{2}(0^2) + C$$

$$450 = c$$

Finally: $s(t) = \frac{-9.8}{2} t^2 + 450.$

(a) Solve: $s(t) = -\frac{9.8}{2} t^2 + 450 = 0$

to find t.

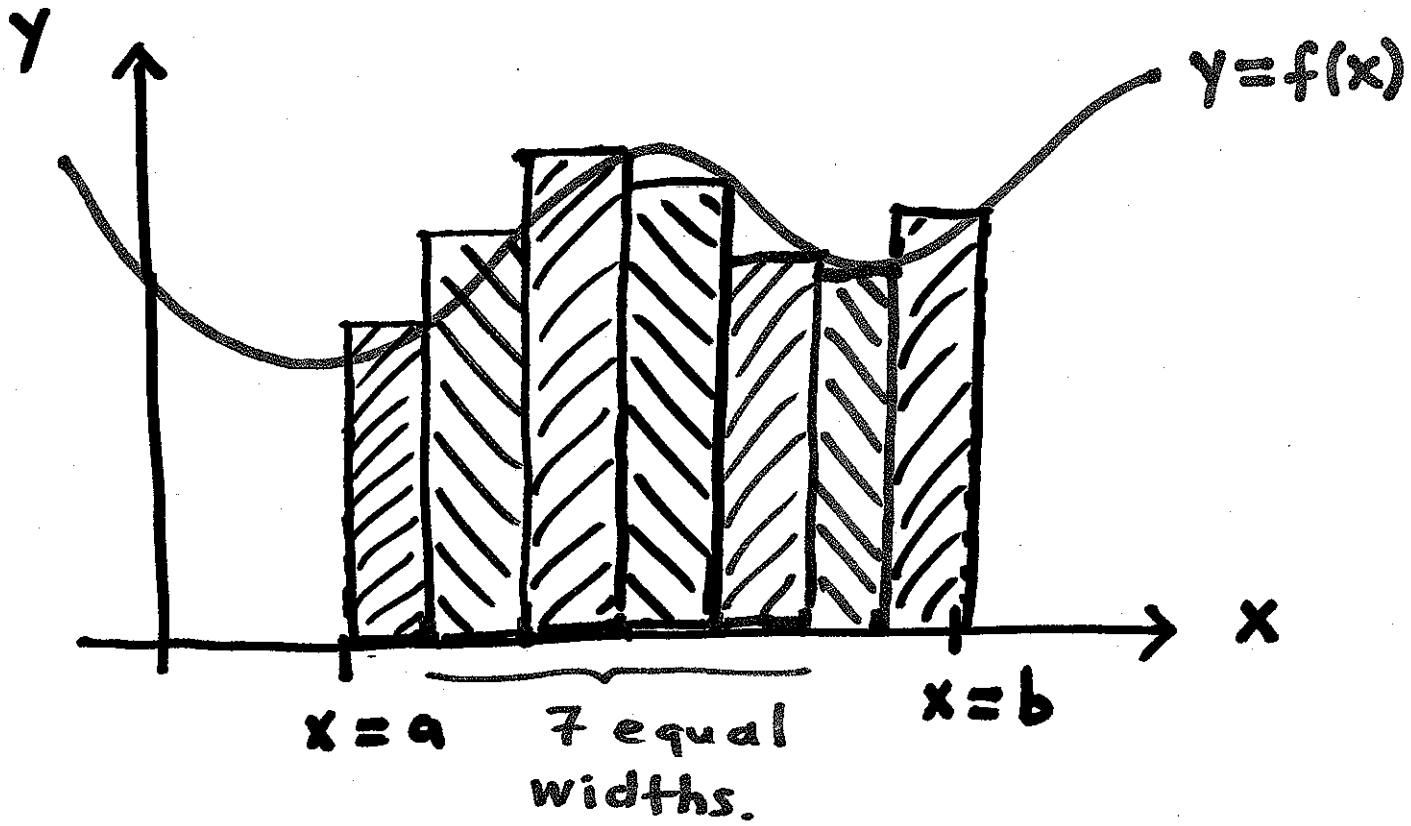
$$t = \sqrt{\frac{900}{9.8}} \approx 9.6 \text{ s}$$

It takes $\approx$ 9.6 seconds for the camera to fall.

(b) Plug $t = 9.6$ into $s'(t)$

$$s'(9.6) = -9.8(9.6) = -94.08 \text{ m/s.}$$

2. Approximating Areas Under Curves



- **Want:** Approximate area between $y = f(x)$ and the x-axis from $x = a$ to $x = b$.
- **Strategy:** 1. Break area into rectangles.
  2. Calculate retangular areas.

3. Add areas together.