The equation that describes the displacement of an object in free fall on the planet earth is

$$s(t) = 16t^2$$

s in feet and t is in seconds.

How long does it take a rock to reach a velocity of 100 miles per hour?

$$\frac{100\ \cancel{mi}}{\cancel{hr}} \cdot \frac{5280\ ft}{1\ \cancel{mi}} \cdot \frac{1\ \cancel{hr}}{3600\ sec} = 146.7\ ft/sec$$

$$v(t) = s'(t) = 32t$$

$$32t = 146.7 \implies t = 4.6\ sec$$

A bullet is fired from the surface of the moon and reaches a height of

$s(t) = 1.5 + 1400t - 2.65t^2$

(s is in feet and t is in seconds)

a) Find the bullet's velocity and acceleration at any time t.

b) How long does it take for the bullet to reach its highest point?

c) How high does the bullet go?

d) How long does it take the bullet to reach half its maximum height?

e) How long is the bullet airborne?

f) What is the bullet's velocity when it hits the surface of the moon?

a) $v(t) = s'(t) = 1400 - 5.3t$

$a(t) = s''(t) = v'(t) = -5.3$

b) when $v(t) = 0 \Rightarrow 1400 - 5.3t = 0$

$\Rightarrow t = 264$ seconds

c) $s(264) = 1.5 + 1400(264) - 2.65(264)^2$

$= 184{,}907$ feet (35 miles)

d) Solve $1.5 + 1400t - 2.65t^2 = \frac{184907}{2}$

$-2.65t^2 + 1400t - 92457 = 0$

Going up: 77 seconds

Going down: 451 seconds

e) $-2.65t^2 + 1400t + 1.5 = 0$

528 seconds or 8.8 minutes

f) $v(528) = 1400 - 5.3(528) \approx -1400$

955 mph

Suppose that the dollar cost of producing x cell phones is

$c(x) = 1400 + 50x - 0.2x^2$

a) Find the average cost of producing the first 110 cell phones.

b) Find $c(111) - c(110)$

c) Find the marginal cost when the production level is 110 cell phones.

a) $\bar{c}(x) = \dfrac{c(x)}{x}$

$\bar{c}(110) = \dfrac{c(110)}{110} = \dfrac{4480}{110} \approx \$40.73$

b) $\dfrac{c(111) - c(110)}{1} = \dfrac{4485.80 - 4480}{1} =$

$\$5.80$

c) marginal = derivative

It's <u>almost</u> the additional amount for produces one more item.

$c'(x) = \lim_{h \to 0} \dfrac{c(x+h) - c(x)}{h}$

$c'(x) = 50 - .4x$

$c'(110) = 50 - .4(110)$

$= 50 - 44.40 = \$5.60$

The demand function for a particular dinner at Bob's

$$p = 10 - 0.003x^2 - \frac{4}{x} \ (10 \le x \le 52),$$

where x is the number of dinners Bob serves daily at price p dollars

1) If Bob wants to sell 20 dinners, what would be the price?

$$p(20) = 10 - 0.003(20)^2 - \frac{4}{20} = \$8.60$$

2) Find the revenue function $R(x) = x\,p(x)$

$$R(x) = 10x - 0.003x^3 - 4$$

3) If the cost function is c(x) = 1.75x, what is the profit function?

$$P(x) = R(x) - c(x) = (10x - 0.003x^3 - 4) - (1.75x)$$
$$= 8.25x - 0.003x^3 - 4$$

4) what is the additional profit at x = 20 derived by selling one more dinner?

```
NORMAL FLOAT AUTO REAL RADIAN CL
Y1(21)-Y1(20)
                         4.467
```

5) What is the marginal profit at x=20?

$$P'(x) = 8.25 - 0.009x^2$$

```
NORMAL FLOAT AUTO REAL RADIAN CL
8.25-.009(20)²
                         4.65
```

6) what should be the price so that Bob gets maximum profit?

Solve $P'(x) = 0$; $8.25 - 0.009x^2 = 0 \Rightarrow$

$$0.009x^2 = 8.25$$

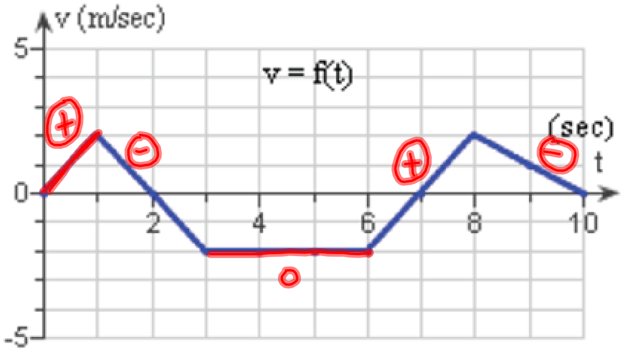
```
NORMAL FLOAT AUTO REAL RADIAN CL
8.25-.009(20)²
                         4.65
8.25/.009
                  916.6666667
√(Ans)
                  30.27650354
```

```
NORMAL FLOAT AUTO REAL RADIAN CL
10-.003(30)²-4/30
                  7.166666667
```

$$p = 10 - 0.003x^2 - \frac{4}{x} \ (10 \le x \le 52),$$

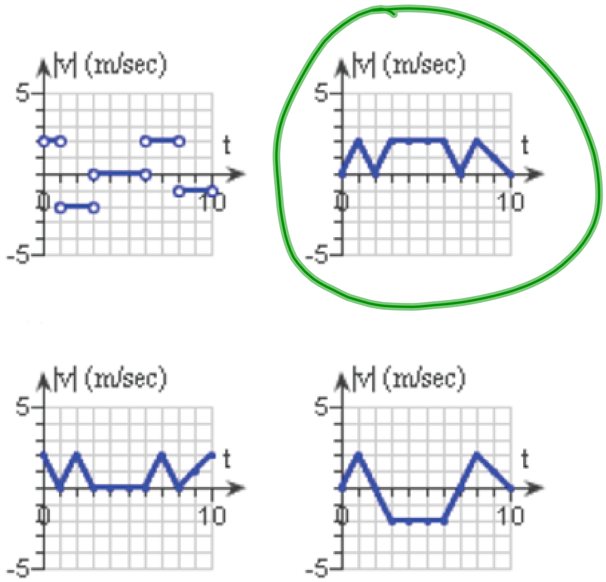
\$7.17

The figure shows the velocity of a man walking a tightrope.



Choose the graph that describes the man's speed.

speed = |v|



Choose the graph that describes the man's acceleration.