Applications KEY

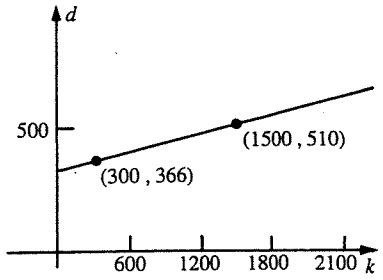
6. *Cost of Owning a Car Problem*

a. Let d = no. of dollars per month.
Let k = no. of km per month.
Ordered pairs are (300, 366), (1500, 510).

$$m = \frac{510 - 366}{1500 - 300} = 0.12$$

$$\therefore d - 366 = 0.12(k - 300)$$
$$\underline{\underline{d = 0.12k + 330}}$$

b.



c. $k = 500$: $d = 0.12(500) + 330 = \underline{\underline{\$390}}$

$k = 1000$: $d = 0.12(1000) + 330 = \underline{\underline{\$450}}$

$k = 2000$: $d = 0.12(2000) + 330 = \underline{\underline{\$570}}$

d. $600 = 0.12d + 330$
$d = 2250$
$\underline{\underline{\text{About 2250 km}}}$.

e. Slope tells you it costs $\underline{\underline{\$.12 \text{ per kilometer}}}$ to drive the car.

f. The \$330 represents the *fixed* costs such as car payments, insurance, etc., which depend only on the fact that you *own* a car, not on how far you drive it.

8. *Thermal Expansion Problem*

a. Let g = no. of cm gap.
Let T = no. of degrees C.
Ordered pairs are (22, 1.3), (30, 0.9).

$$\therefore m = \frac{0.9 - 1.3}{30 - 22} = \frac{-0.4}{8} = -0.05$$

$$\therefore g = 0.9 = -0.05(T - 30) \quad \text{or} \quad \underline{\underline{g = -0.05T + 2.4}}$$

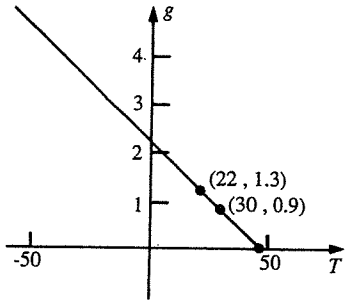
b. $T = 35$: $g = -0.05(35) + 2.4 = \underline{\underline{0.65 \text{ cm}}}$

$T = -10$: $g = -0.05(-10) + 2.4 = \underline{\underline{2.9 \text{ cm}}}$

c. $g = 0$: $0 = -0.05T + 2.4$
$0.05T = 2.4$
$T = 48$
$\therefore$ gap would close at $\underline{\underline{48°\text{C}}}$, which is the $\underline{T\text{-intercept}}$.

d. The *air* temperature would probably not reach 48°C, but the *bridge* could be quite a bit hotter than the air due to heating by the Sun. So the bridge temperature *could* reach 48°C.

e.



10. *Gas Tank Problem*

a. g depends on t.

b. Ordered pairs are (40, 52), (60, 40).

$$m = \frac{40 - 52}{60 - 40} = -\frac{3}{5}$$

$$g - 40 = -\frac{3}{5}(t - 60)$$

$$\underline{\underline{g = -\frac{3}{5}t + 76}}$$

c. $g = 0$:

$$0 = \frac{3}{5}t + 76$$

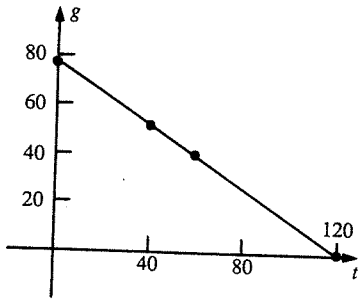
$$t = 126\frac{2}{3}$$

After $126\frac{2}{3}$ minutes.

d. g-intercept is $\underline{76}$.

Gas tank holds $\underline{76 \text{ liters when full}}$.

e.



f. The slope tells you that the car uses gasoline at a rate of $\frac{3}{5}$ liter per minute. The "$-$" sign shows that the amount of gasoline remaining *decreases* as time goes on.

16. *Charles's Gas Law*

a. Let V = no. of cubic centimeters (cm^3).
Let T = no. of degrees C.
Ordered pairs are (27, 500), (90, 605).

$$\therefore m = \frac{605 - 500}{90 - 27} = \frac{105}{63} = \frac{5}{3}$$

$$\therefore V - 500 = \frac{5}{3}(T - 27) \quad \text{or} \quad \underline{\underline{V = \frac{5}{3}T + 455}}$$

b. $T = 60$: $V = \frac{5}{3}(60) + 455 = \underline{\underline{555\ cm^3}}$

c. "Inter-" means "between," and "-pole" means "end." So "interpolation" means "between the ends."

d. $T = 300$: $V = \frac{5}{3}(300) + 455 = \underline{\underline{955\ cm^3}}$

e. "Extra-" means "outside," and "-pole" means "end." So "extrapolation" means "outside the ends."

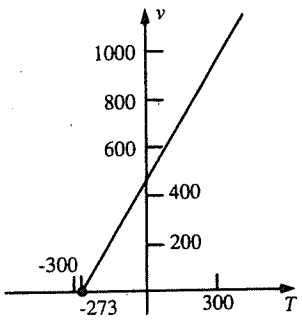
f. $V = 0$: $\quad 0 = \frac{5}{3}T + 455$

$$\frac{5}{3}T = -455$$

$$T = \underline{\underline{-273°C}}$$

g. $-273°C$ is called "absolute zero." See Problem 13.f.

h. Graph.



18. *Speeding Bullet Problem*

s = no. of feet per second.
d = no. of feet.

a. s varies linearly with d because the equation $s = -4d + 3600$ has the form of the general linear equation, $y = mx + b$.

b. $s = -4(300) + 3600 = 2400$
$\underline{\underline{2400\ ft/sec.}}$

c. $500 = -4d + 3600$
$d = 775$
$\underline{\underline{775\ feet}}$

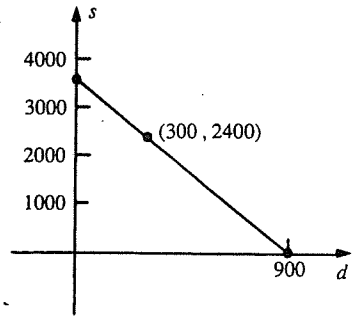
d. Slope is the number of ft/sec the bullet slows down for each foot it travels. (It is the *acceleration*.)

e. $0 = -4d + 3600$
$d = \underline{\underline{900}}$

Bullet goes a maximum of 900 ft. before it stops.

f. Domain: $0 \le d \le 900$.

g.



20. *Direct Variation, Pancake Problem*

a. Let c = no. of cups.
Let p = no. of people.
Ordered pairs are (0, 0) and (10, 7).

$$\therefore m = \frac{7 - 0}{10 - 0} = 0.7$$

$$\therefore c - 0 = 0.7(p - 0) \text{ or } \underline{\underline{c = 0.7p}}$$

b. $p = 50$: $\quad c = 0.7(50)$
$= \underline{\underline{35\ cups}}$

c. $c = 12$: $\quad 12 = 0.7p$

$$p = \frac{12}{0.7}$$

$$\approx 17.14$$

So you could serve
$\underline{\text{about 17 people}}$.

d. Graph.
Graph contains the
$\underline{\text{origin}}$.