

PC MORE SYSTEMS PROBLEMS: key

1. A coffee merchant has two types of coffee beans, one selling for \$9 per pound and the other for \$15 per pound. The beans are to be mixed to provide 100 lb of a mixture selling for \$13.50 per pound. How much of each type of coffee bean should be used to form 100 lb of the mixture?

Let  $x = \#$  pounds \$9 coffee  
 $y = \#$  pounds \$15 coffee

25 lbs \$9  
 75 lbs \$15

Q:  $x + y = 100 \rightarrow y = 100 - x$   
 V:  $9x + 15y = 13.50(100)$   
 SO  
 $9x + 15(100 - x) = 1350$   
 $9x + 1500 - 15x = 1350$   
 $-6x = -150$   
 $x = 25$

2. A candy merchant wants to mix peanuts selling at \$2.20 per pound with cashews selling at \$5.40 per pound to form 120 lb of a mixed-nut blend that will sell for \$3 per pound. What amount of each type of nut should be used?

let  $p = \#$  pounds peanuts  $c = \#$  pounds cashews

$p + c = 120 \rightarrow p = 120 - c$   
 $2.20p + 5.40c = 120(3)$   
 SO  $2.20(120 - c) + 5.40c = 360$   
 $264 - 2.20c + 5.40c = 360$   
 $3.2c = 96$   
 $c = 30$

30 lbs cashews, 90 lb peanuts

3. Miguel has \$3000 more invested in a mutual fund paying 5% interest than in a savings account paying 3%. If he received \$310 in interest for 1 year, how much did he have invested in the two accounts?

let  $x = \#$  in 5% acct  
 $y = \#$  in 3% acct

$0.05x + 0.03y = 310$   
 $x = y + 3000$

$y = 2000$   
 $x = 5000$

|      |     |
|------|-----|
| 3000 | 0   |
| 3100 | 100 |
| 3200 | 200 |

SO  $x = y + 3000$

$0.05(y + 3000) + 0.03y = 310$   
 $0.05y + 150 + 0.03y = 310$   
 $0.08y = 160$

~~$0.08y = 295$~~   
 ~~$y = 3687.50$~~   
 ~~$x = 6687.50$~~

4. A jet flew east a distance of 1800 mi with the jetstream in 3 h. Returning west, against the jetstream, the jet took 4 h. Find the jet's speed in still air and the rate of the jetstream.

w/ jetstream  
agst

|              | $r =$   | $t$ | $= d$ |
|--------------|---------|-----|-------|
| w/ jetstream | $r + j$ | 3   | 1800  |
| agst         | $r - j$ | 4   | 1800  |

$r =$  speed in still air  
 $j =$  rate of jetstream

$$3r + 3j = 1800 \rightarrow 12r + 12j = 7200$$

$$4r - 4j = 1800 \rightarrow 12r - 12j = 5400$$

$$\begin{array}{r} 24r = 12,600 \\ \hline r = 525 \text{ mph} \end{array}$$

5. A chemistry teacher needs to make 10 L of 42% sulphuric acid solution. The acid solutions available are 30% sulphuric acid and 50% sulphuric acid, by volume. How many liters of each solution must be mixed to make the 42% solution?

$x =$  # liters of 50%  
 $y =$  # L of 30%

$$\begin{array}{r} 3j = 225 \\ \hline j = 75 \text{ mph} \end{array}$$

Q:  $x + y = 10 \rightarrow y = 10 - x$

$$.50x + .30y = .42(10) \rightarrow .50x + .30(10 - x) = 4.2$$

$$.50x + 3 - .30x = 4.2$$

$$.20x = 1.2$$

$$x = 6 \text{ liters}$$

6 liters 50%  
4 liters 30%

6. A boat traveled 24 miles downstream in 2 hours. The return trip took twice as long. What is the speed of the boat in still water?

|      | $r$     | $t$ | $d$ |                     |
|------|---------|-----|-----|---------------------|
| down | $b + c$ | 2   | 24  | $b =$ speed boat    |
| up   | $b - c$ | 4   | 24  | $c =$ speed current |

$$2b + 2c = 24 \rightarrow 4b + 4c = 48$$

$$4b - 4c = 24$$

$$\begin{array}{r} 8b = 72 \\ \hline b = 9 \text{ mph} \end{array}$$

$$c = 3 \text{ mph}$$

ANALYZING FUNCTIONS AS APPLICATIONS

Use your calculator to answer the following questions. Write all answers in complete sentences. If asked for approximations, round answers to the nearest tenth.

1) Ibuprofen is a medication used to relieve pain. The polynomial function

$$M(t) = .5t^4 + 3.45t^3 - 96.65t^2 + 347.7t$$

where  $0 \leq t \leq 6$

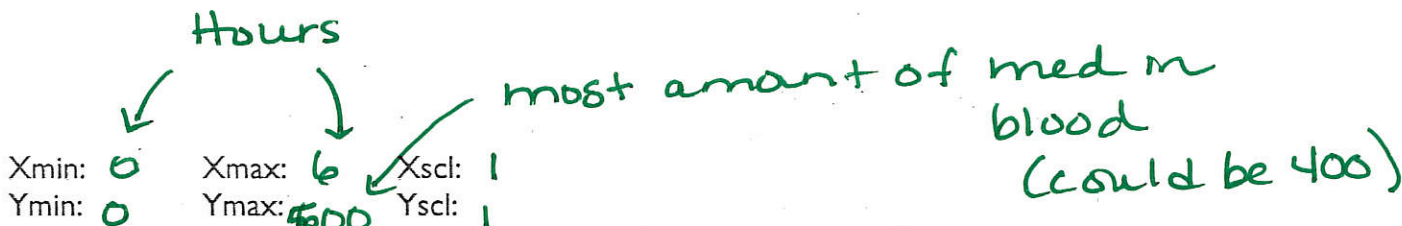
can be used to estimate the number of milligrams of ibuprofen in the bloodstream  $t$  hours after 400 mg of the medication has been swallowed.

a) Define the variables in the function. Identify which variable is dependent and which is independent. Explain.

let  $t$  = time in hours after 400mg taken (independent)

let  $M(t)$  = amount of ibuprofen in bloodstream  $t$  hours after it's taken

b) Graph the function over the given domain.



c) Estimate the amount of ibuprofen that will be in the bloodstream one hour after 400 mg has been swallowed. 1 hour → sub in 1 for  $t$  into eq.

d) Find when the maximum amount of ibuprofen will be in your bloodstream. OR, Graph on g.c. Then use CALC VALUE,

Calc max. 2.15 hours after injected → 2 hours, 9 min.

e) Write where the function is increasing and decreasing (in interval notation)

$x = 1$   
255 mg

Increasing:  $(0, 2.15)$

Decreasing:  $(2.15, 6)$

- 2) During a 24-hour period, the temperature  $T$  (in degrees Fahrenheit) of a certain city can be approximated by the model

$$T(x) = 0.026x^3 - 1.03x^2 + 10.2x + 34 \quad \text{where } 0 \leq x \leq 24$$

where  $x$  represents the time of day, with  $x=0$  corresponding to 6 a.m.

- a) Define the variables in the function. Identify which is dependent and which is independent. Explain.

$x = \#$  hours after 6 a.m. (independent)  
 $y =$  Temperature in deg. far.

- b) Graph the function over the given domain.

Xmin: 0      Xmax: 24      Xscl: 1  
 Ymin: 0      Ymax:      Yscl:

↑  
 Temperature  $\therefore 100^\circ$ ?

- c) What is the approximate temperature at 11 a.m.? at 6 p.m.? at midnight?

64°      11 a.m.  $\rightarrow x = 5 \rightarrow$  sub in 5 or calc value  $x = 5$   
 53°      6 p.m.  $\rightarrow x = 12 \rightarrow$   
 35.5      midnight  $\rightarrow x = 18$

- d) At what time does the maximum temperature occur? What is the maximum temperature?

6.6 hours after 6 am  $\rightarrow$  12:36 pm

- e) At what time does the minimum temperature occur? What is the minimum temperature?

19.8 hours after 6am  $\rightarrow$  1:48 a.m.  
 $-6/13.8$

- f) Write where the function is increasing and decreasing (in interval notation)

Increasing:  $[0, 6.6) \cup (19.8, 24]$

Decreasing:  $(6.6, 19.8)$