

# FUN WITH FUNDAMENTALS

## Incomplete sentence

**Problem 173** — The wheels of justice don't always run together, as this month's problem by Victoria Baker of Salem, N.H., demonstrates.

"Fixed?" Warden Lockjaw asked delicately.

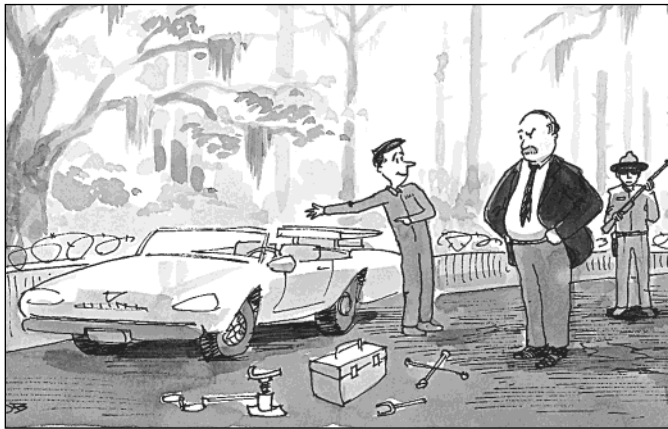
\*Hiccup\* "Of course," replied Finagel J. Wurme.

It was Wurme's last day at the Swamptown Honor Farm (See May '93), and he had graciously offered to prep the warden's car for the annual "Swamptown 500."

"I measured the track," hiccuped Wurme, "and fixed the car so you won't have to steer. As you know, the car is 5 ft wide and is a rear-wheel drive model. I've mounted the front wheels 4 ft apart on a split axle — \*hiccup\* — that drives them at different speeds. The left front wheel will be rotating 28% faster than the right front. Also, I — \*hiccup\* — fixed

the wheel diameters to follow the track. The left front is 21 in., and the right front, 27 in. The steering wheel will be locked into position with the front wheels paral-

le. The track itself has a constant width of 50 ft. Surrounding the track at all points except the starting line is the swamp for which the town is named.



lel to the longitudinal axis of the car.

The track on which the Swamptown 500 will be raced consists of two semicircles separated by  $1/8$ -mile straight sections. The diameter of the inside edge of the track around the semicircles is  $1/4$

Neglect frictional forces and the width of the tires. Assume the rear wheels follow the front. Will Lockjaw's car be able to stay on the track? Compute the diameter of the circle described by Lockjaw's car to see if a tow truck with an extra-long winch should be standing by. Send your answer to:

Fun With Fundamentals  
POWER TRANSMISSION  
DESIGN

1100 Superior Ave.

Cleveland, OH 44114-2543

Deadline is July 10. Good luck!

*Technical consultant, Jack Couillard,  
Menasha, Wis.*

**Solution to last month's problem 172**

— You know when to run for it, if you answered 49.8 in. for the rocket's wick. Here's how Gotrock's shindig once again made the front page.

Let:

$v_o$  = initial velocity, given as 0 fps

$v_i$  = velocity when upward acceleration stops, fps

$v_f$  = velocity at maximum height, fps

$a$  = acceleration, given as  $60 \text{ fps}^2$

$t_o$  = duration of acceleration, given as 8 sec

$t_i$  = duration of upward flight after upward acceleration stops, sec

$b$  = burn rate of wick, given as 2 ips

We must determine how long it takes the rocket to reach its maximum height. First, determine  $v_i$ .

$$\begin{aligned} v_i &= v_o + at_o \\ &= 0 + (60 \text{ fps}^2)(8 \text{ sec}) \\ &= 480 \text{ fps} \end{aligned}$$

Next, determine  $t_i$ .

$$\begin{aligned} v_f &= v_i + gt \\ 0 &= 480 \text{ fps} + (-32.2 \text{ fps}^2)t_i \\ t_i &= 14.9 \text{ sec} \end{aligned}$$

The total time until the rocket reaches its zenith is  $t_o + t_i$ . The length of wick required to explode the fireworks at the zenith point is (Don't forget the 4 in. of wick attached to the rocket!):

$$\begin{aligned} (t_o + t_i)b + 4 \text{ in.} &= 49.8 \text{ in.} \\ (2 \text{ ips})(8 \text{ sec} + 14.9 \text{ sec}) + 4 \text{ in.} &= 49.8 \text{ in.} \end{aligned}$$

The evening was capped off by a visit from the fire department!

**Contest winner** — Congratulations to Donald L. Clarke of Lowell, Mich., who won our April contest by having his name drawn from the 474 contestants who answered correctly out of a total of 496 for that month. A TI-68 calculator is in the mail to him.

The TI-68 Advanced Scientific Calculator by Texas Instruments can solve five simultaneous equations with real and complex coef-



ficients and has 40 number functions that can be used in both the rectangular and polar coordinate systems. Other functions include formula programming, integration,

and polynomial root finding. The calculator also features a last-equation replay function that lets you double-check your work.

To enter the contest, send your answer on a postcard or letter to POWER TRANSMISSION DESIGN, 1100 Superior Ave., Cleveland, OH 44114-2543.

You can also receive a TI-68 and credit in the magazine if you send in an *original* problem with solution, and we publish it.