

## I-96

A rocket of mass  $m$  is fired vertically upward from rest. The rocket's engine produces a thrust of constant magnitude  $F_{\text{thrust}}$  for  $t_{\text{thrust}}$  seconds. Determine the time it takes the rocket to reach its apex ( $t_{\text{apex}}$ ) as a function of  $F_{\text{thrust}}$ ,  $t_{\text{thrust}}$ ,  $m$ , and  $g$ .

### Motion Information Body Diagrams

### Free-

Event 1:                  Event 2:                  Event 3:                  *before engine turns off*      *after engine turns off*

$t_1 =$                        $t_2 =$                        $t_3 =$

$r_1 =$                        $r_2 =$                        $r_3 =$

$v_1 =$                        $v_2 =$                        $v_3 =$

$a_{12} =$                        $a_{23} =$



### Mathematical Analysis

### Questions

If  $g = 0 \text{ m/s}^2$ , what should  $t_{\text{apex}}$  equal? Does your function agree with this observation?

If  $F_{\text{thrust}} = mg$ , what should  $t_{\text{apex}}$  equal? Does your function agree with this observation?

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