1. Natasha throws a rock with a mass of 0.20 kg straight up. It reaches a height of 5 m from the point it was released.
   a. How does the force on the rock at its maximum height compare to the force on the rock immediately after it leaves her hand? (assume all of this is taking place in a vacuum!) (5)
   b. What was the rock’s initial speed? (10)
   c. How long does it take to return to its release point? (10)

2. Bullwinkle has found a treasure map (with a big X marking the spot). Unfortunately he and Rocky cannot travel toward it in a straight line (because Boris has set up a Tasmanian tiger trap). Therefore, they walk 100 m due west then turn 75° toward the south and proceed another 200 m. What is the displacement of the treasure from their original position? (10)

3. Boris steals a steam roller with the intent to flatten our heroes. He puts it into gear and stomps on the accelerator. Identify the force on the steam roller that gets it up to speed? (5)

4. The glacier in the mountains above Frostbite Falls has moved 100 m during the past year. What is its speed in furlongs per fortnight? (10)

5. Boris writes down a secret formula for Rocky’s flight through the air:

   \[ y^2 = v^2 t^2 - \frac{ Ft }{ 2m } \]

   (where \( y, v, t, F, \) and \( m \) take on the usual meanings). What is wrong with this formula? Or does it make sense? Why or why not? (5)

6. Boris thinks that \( \pi \) has the value 3 (why should evil spy use fractions—leave them for moose and squirrel). He measures the radius of a circle to be 100 ft (to the nearest 5 ft).
   a. What value of the area of the circle does he get? (3)
   b. Rocky uses a better value of 3.14159 26536. What does he get for the area? (3)
   c. What is the accuracy of Boris’s area? (7)
   d. To what precision could the area be determined? (7)

7. One of Boris and Natasha’s nefarious schemes has gone astray. They steal a hotrod to make their getaway but discover the bridge is out ahead of them. At 117 mph Boris hits the brakes and the car skids. If the coefficient of friction between the rubber tires and the road is 0.8, then what acceleration can they obtain? Assume the weight of the car (and Natasha and Boris) is 1236 N. (10)
8. Unbeknownst to our heroes, Boris has suspended a 1.4 kg bomb from the inside top of the truck they are riding in using a rope that is 1.2 m in length. As they accelerate, the rope makes an angle of 15° from the vertical. What is the acceleration of the truck? (15)

| 1 furlong | = | 1/8 mile | 1 year | = | 365.25 days |
| 1 inch | = | 2.54 cm | 1 fortnight | = | 2 weeks |
| 1 foot | = | 12 inches | 1 week | = | 7 days |
| 1 mile | = | 5280 ft |

Why is this an antihistamine test?