1. **Question Details**

   (a) Express the following angles in radians.
   
   \[ 25° = 0.436 \text{ rad} \]
   \[ 35° = 0.611 \text{ rad} \]
   \[ 80° = 1.4 \text{ rad} \]
   \[ 250° = 4.36 \text{ rad} \]

   (b) The following angles are in units of radians. Express them in degrees.
   
   \[ \frac{\pi}{5} = 36° \]
   \[ 0.60 \pi = 108° \]
   \[ 1.6 \pi = 288° \]
   \[ 8 \pi = 1440° \]

   (c) The following angles are in units of radians. Express them in units of revolutions.
   
   \[ \frac{\pi}{5} = 0.1 \text{ rev} \]
   \[ 0.60 \pi = 0.3 \text{ rev} \]
   \[ 1.6 \pi = 0.8 \text{ rev} \]
   \[ 8 \pi = 4 \text{ rev} \]

2. **Question Details**

   A bicycle tire of radius 0.42 m has a piece of gum stuck on its rim. What is the angle through which the tire rotates when the gum has moved through a linear distance of 1.84 m? Express your answer in radians and degrees.
   
   \[ 4.38 \text{ rad} \]
   \[ 251° \]

3. **Question Details**

   An automobile with 0.320 m radius tires travels 80,000 km before wearing them out. How many revolutions do the tires make, neglecting any backing up and any change in radius due to wear?

   \[ 3.96 \times 10^7 \text{ rev} \]

4. **Question Details**

   A truck with 0.385 m radius tires travels at 44.5 m/s. At how many radians per second are the tires rotating?

   \[ 116 \text{ rad/s} \]

5. **Question Details**

   Mary and her younger brother Alex decide to ride the 17-foot-diameter carousel at the State Fair. Mary sits on one of the horses in the outer section at a distance of 6 feet from the center. Alex decides to play it safe and chooses to sit in the inner section at a distance of 5 feet from the center.

   (a) What is Mary's angular speed \( \omega_M \) compared to that of Alex's angular speed \( \omega_A \)? Give your answer as a multiple of \( \omega_A \).

   \[ \omega_M = 1 \omega_A \]

   (b) What is Mary's tangential speed \( v_M \) compared to that of Alex's tangential speed \( v_A \)? Give your answer as a multiple of \( v_A \).

   \[ v_M = 1.6 v_A \]

6. **Question Details**

   The length of the slope of a mountain is 2660 m, and it makes an angle of 13.7° with the horizontal. What is the height of the mountain, relative to its base?

   \[ 630 \text{ m} \]
A cheetah is running at a speed of 20.4 m/s in a direction of 43° north of west. Find the components of the cheetah's velocity along the following directions.

(a) the velocity component due north
13.9 m/s

(b) the velocity component due west
14.9 m/s

Two position vectors, \( \vec{A} \) and \( \vec{B} \), are shown in the diagram below. The green arrow represents vector \( \vec{A} \) while the red one represents \( \vec{B} \). The components of the vectors are as follows:

\[ A_x = -7 \text{ cm}, \ A_y = 19 \text{ cm} \]
\[ B_x = 19 \text{ cm}, \ B_y = -8 \text{ cm}. \]

For each of the given expressions, calculate the magnitude of the resultant vector, and select the diagram that is the best graphical (tail-to-head method) representation of the vectors and the resultant.

(a) \( \vec{C} = \vec{A} + \vec{B} \)
16.3 cm
While in a park, you walk west for 52 m, then you walk 32.1° north of west for 41 m, and finally you walk due north for 25 m. Find the components of your final displacement, from your initial to final point, along the north and west directions.

(a) displacement component due north

(b) displacement component due west

A new landowner has a triangular piece of flat land she wishes to fence. Starting at the west corner, she measures the first side to be 80 m long and the next to be 105 m -- these sides are represented as displacement vectors $\mathbf{A}$ and $\mathbf{B}$ in Figure 3.26, where $\theta_1=23^\circ$, and $\theta_2=13^\circ$. She then correctly calculates the length and orientation of the third side $\mathbf{C}$. What is her result?

86.9 m
54.9° south of west