1. Which of the following equations is correct?

\[ \vec{A} + \vec{B} = \vec{D} - \vec{C} \quad (2) \quad \vec{A} = \vec{B} + \vec{D} \quad (3) \quad \vec{B} = \vec{A} + \vec{C} - \vec{D} \quad (4) \quad \vec{C} = \vec{A} + \vec{B} + \vec{D} \quad (5) \quad \vec{A} - \vec{B} = \vec{C} + \vec{D} \]

2. An airplane is flying straight east with a velocity of 300 km/h relative to the surrounding air. But the air itself is moving southwest (that is, 45° south of west) relative to the earth with a velocity of 100 km/h due to a strong wind. What is the speed of the plane relative to the earth in km/h?

(1) 240 \hspace{1cm} (2) 380 \hspace{1cm} (3) 200 \hspace{1cm} (4) 300 \hspace{1cm} (5) 100

3. A ball is thrown at 2 m/s horizontally. It lands 20 m away from starting point. What is \( h \) (in m)?

(1) 490.0 \hspace{1cm} (2) 75 \hspace{1cm} (3) 3 \hspace{1cm} (4) 56.3 \hspace{1cm} (5) 408

4. No matter how powerful a car’s motor, it can accelerate no faster than the friction force between pavement and wheels allows. For this reason, a typical car’s maximum acceleration is about 8 m/s\(^2\). What is the shortest time a car would require to accelerate from rest to a speed of 30 m/s?

(1) 3.75 s \hspace{1cm} (2) 56.3 s \hspace{1cm} (3) 2.74 s \hspace{1cm} (4) 8.00 s \hspace{1cm} (5) 0.267 s
5. A car moving at 90 km/hr collides into a row of bushes. It moves 10 m before it completely stops. Suppose its mass is equal to 2000 kg. What is the average force which acted on the car? (in N)

(1) $-6.2 \times 10^4$ N (2) 4300 N (3) $3.7 \times 10^5$ N (4) $-3.7 \times 10^5$ N (5) no force

6. For the situation shown, $M_1$ is 500 g and $M_2$ is 600 g. How large must the tension $P$ in the upper cord be to move the mass upward at a constant speed of 2.0 m/s?

(1) 10.8 N (2) 1100 N (3) 100 N (4) 4.9 N (5) 13.0 N

7. Given $m_1 = 12$ kg, $m_2 = 20$ kg, and $a = 5$ m/s, find the coefficient of friction.

(1) 0.31 (2) 0.52 (3) 2.6 (4) 0.42 (5) 0.26

8. Refer to figure. How large is $P$ if the box moves up the incline at constant speed? The box has a mass of 5.0 kg and $\mu_k = 0.40$.

(1) 41.5 N (2) 7.4 N (3) 66.8 N (4) 18.0 N (5) 19.5 N

9. A ring remains at rest with three strings pulling on it. One string pulls with a force of 25 N at an angle of 90°. The other pulls with a force of 70 N at an angle of 270°. What is the magnitude and direction of the force caused by the third string?

(1) 45 N at 90° (2) 45 N at 180° (3) 45 N at 0° (4) 95 N at 90° (5) 95 N at 270°

10. A uniform ladder that weighs 200 N leans against a smooth wall as shown. At a smooth surface such as the wall, the surface exerts a force $P$ on the ladder which is directed perpendicular to the wall. How large must the horizontal force $H$ on the foot of the ladder be if the ladder is not to slip?

(1) 46.6 N (2) 215 N (3) 200 N (4) 65 N (5) 93.5 N