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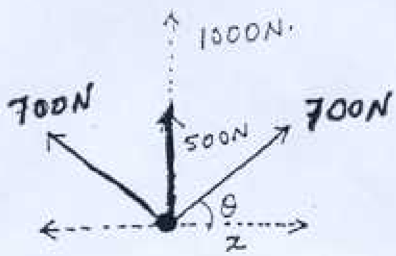
Ch3: Q: 18*, 40, 59/E: 12, 20, 24; A4 Q2,6/E: 1,6
* (See Q3.17 on p4A4, originally assigned in error.)

3:Q 18) Force is a vector quantity and therefore two forces acting on a body add vectorially. If the two 700N forces are directed such that their y components equal 500N and the x components are equal and opposite, then it is possible to have a force of magnitude 1000N in the y direction

Eg.



$\sin\theta = \frac{500}{700}$ or $\theta = \sin^{-1}\left(\frac{5}{7}\right)$

$$x^2 + 500^2 = 700^2$$

$$x = \sqrt{700^2 - 500^2} \approx 490$$

(Note: $\hat{i}$ is unit vector in x-direction, and $\hat{j}$ is unit vector in y-direction.)

$\therefore$ if $\vec{F}_1 = 490\hat{i} + 500\hat{j}$

and $\vec{F}_2 = -490\hat{i} + 500\hat{j}$

then the two forces can add to give a 1000N force in the upward direction. (In fact any force magnitude between 0N and 1400N can be obtained by proper orientation of these forces.)

3: Q40 Since both of the crates are moving at constant velocity their net acceleration is zero and $\therefore$ the net force on each is zero, and both forces are the same.

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3:Q59) The two forces act on different objects; ∴ the two forces cannot cancel. If these are the only two forces acting, both the horse and the cart accelerate towards one another. In the actual situation, the frictional force of the ground on the horse's hooves allows the horse to move the cart.

3:E12) Mass of the object = 1200 kg

Average acceleration = 4 m/s².

Average force = mass × acceleration

$= 1200\ \text{kg} \times 4\ \text{m/s}^2$

$= 4800\ \text{N}.$

NII: $\vec{F}_{NET} = m\vec{a}$

3:E20) i.e. Tension − force of friction = mass × acceleration.

$T - 50\text{N} = 10\ \text{kg} \times 3\ \text{m/s}^2$

$T - 50\text{N} = 30\text{N}$

$T = 80\text{N}$

3:E24) Force exerted by the mother on the daughter

= mass of the daughter × acceleration of the daughter

$= 25\ \text{kg} \times 2\ \text{m/s}^2 = \boxed{50\text{N}}$ by (NII).

& (NIII): Force exerted by the daughter on the mother = Force exerted by the mother on the daughter = $\boxed{50\text{N}}$.

Acceleration of the mother = $\dfrac{\text{Force on the mother}}{\text{Mass of Mother}} = \dfrac{50\text{N}}{50\text{kg}} = \boxed{1\ \text{m/s}^2}$

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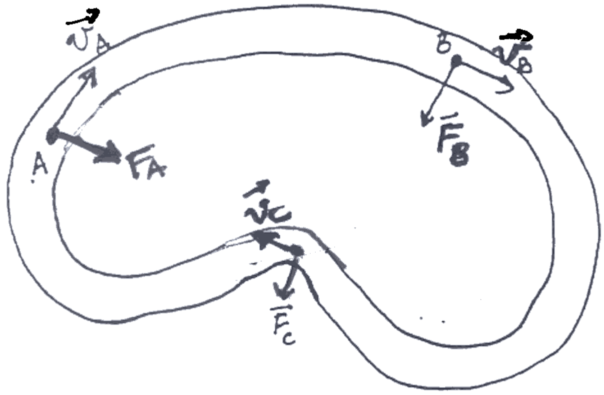
4: Q2.



In case of an oil slick, car A would move (in a straight line path) in the direction of its velocity because of (NI): there would be no net force on it.

Ch 4 Q 6

Velocity – tangential

change in velocity, acceleration & net force all point towards the center of the carousel.

4: E1. (a) (Velocity changes from) 5 m/s west to 10 m/s west:

$\vec{v}_i$ 5 m/s, $\vec{v}_f$ 10 m/s.

Vector change in velocity = $\boxed{5\,m/s \text{ west}} = \vec{v}_f - \vec{v}_i$

(b) From 10 m/s west to 5 m/s west

$\vec{v}_i$ 10 m/s, $\vec{v}_f$ 5 m/s

Vector change in velocity = $\boxed{5\,m/s \text{ East}} = \vec{v}_f - \vec{v}_i$

(c) From 5 m/s west to 10 m/s east

$\vec{v}_i$ 5 m/s, $\vec{v}_f$ 10 m/s

Vector change in velocity = $\boxed{15\,m/s \text{ east}} = \vec{v}_f - \vec{v}_i$

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4.E 6

E $\xleftarrow{\vec{v}_i}$ 8 m/s.

(Let W → be + direction
Then East is − ")

$\longrightarrow$ W
$\vec{v}_f = 12$ m/s.

$\vec{v}_f - \vec{v}_i = \Delta\vec{v} =$ 20 m/s west. $= +12 - (-8) = +20 \frac{m}{sec}$

ALSO, $\Delta t =$ 0.5 s, so that

average acceleration $\vec{a}_{AVG} = \frac{\Delta\vec{v}}{\Delta t} = \frac{20\,m/s}{0.5\,s}$ West $=$ 40 m/s^2 West

Note Added

In Ch 3, C. Question 17 was assigned by error instead of 3Q.18, which is a more interesting problem.
The solution to 3Q.17 follows:

3 Q.17* The minimum value of the sum of two vectors of fixed magnitude but arbitrary orientation occurs when the vectors oppose one another. For $|\vec{F}_1| = 4$, $|\vec{F}_2| = 6$ the minimum magnitude for the sum $|\vec{F}_{NET}|$ is obtained when $\vec{F}_1$ is directed opposite to $\vec{F}_2$:
Then $|\vec{F}_{NET}| = +6 - 4 = +2$ is the minimum Force which $(\vec{F}_1 + \vec{F}_2)$ can yield. (Incidentally, the MAXIMUM occurs when VECTORS $\vec{F}_1$ & $\vec{F}_2$ are ∥: $|F^{MAX}_{NET}| = 6 + 4$, & EVERY $2 \leq |F_{NET}| \leq 10$ can be obtained by choosing the angle between $\vec{F}_1$ & $\vec{F}_2$.)