14JAN10

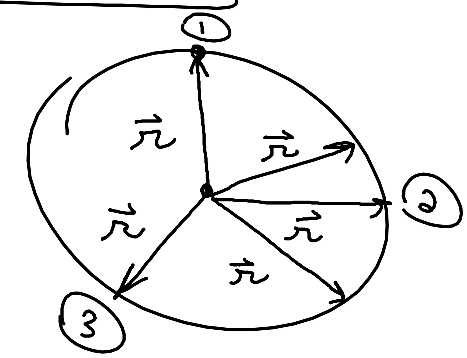
- HW Q & A
- TI calculator programs

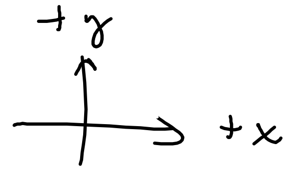
•58 What is the magnitude of the acceleration of a sprinter running at 10 m/s when rounding a turn of a radius 25 m?

$$a_c = \frac{v^2}{r} = \frac{(10\,m/s)^2}{25\,m} = \frac{100\,m^2/s^2}{25\,m} = \boxed{4\,m/s^2}$$

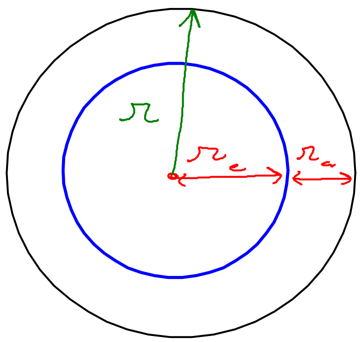
$$\boxed{\vec{a}_c = -\frac{v^2}{r}\,\hat{r}}$$

r r r r — r





•60 An Earth satellite moves in a circular orbit 640 km above Earth's surface with a period of 98.0 min. What are the (a) speed and (b) magnitude of the centripetal acceleration of the satellite?



$r_e = 6{,}378{,}000\ m$

$r_a = 640{,}000\ m$

$r = r_e + r_a$

$= 7{,}018{,}000\ m$

$T = 98\ min \times 60\ s/min = 5{,}880\ s$

$C = 2\pi r = 44{,}095{,}394.486\ m$

$v = \frac{C}{T} = \boxed{7449.217\ m/s}$

so.... $a_c = \frac{v^2}{r} = \frac{(7449.217)^2}{7{,}018{,}000} = \boxed{8.013\ m/s^2}$

•62 A rotating fan completes 1200 revolutions every minute. Consider the tip of a blade, at a radius of 0.15 m.

(a) Through what distance does the tip move in one revolution? What are (b) the tip's speed and (c) the magnitude of its acceleration? (d) What is the period of the motion?

(a) $C = 2\pi r = 2\pi(0.15) = 0.942\text{ m}$

(b) $1200 \frac{\text{rev}}{\text{min}} \times \frac{0.942\text{ m}}{1\text{ rev}} \times \frac{1\text{ min}}{60\text{ s}} = 18.84\text{ m/s}$

(c) $a_c = \frac{v^2}{r} = \frac{(18.84)^2}{0.15} = 2366.304\text{ m/s}^2$

(d) $\frac{1\text{ min}}{1200\text{ revs}} = \frac{1}{1200}\frac{\text{min}}{\text{rev}} \times \frac{60\text{ s}}{1\text{ min}} = 0.05 \frac{\text{s}}{\text{rev}}$

••63 A purse at radius 2.00 m and a wallet at radius 3.00 m travel in uniform circular motion on the floor of a merry-go-round as the ride turns. They are on the same radial line. At one instant, the acceleration of the purse is $(2.00\ \mathrm{m/s^2})\hat{\imath} + (4.00\ \mathrm{m/s^2})\hat{\jmath}$. At that instant and in unit-vector notation, what is the acceleration of the wallet?

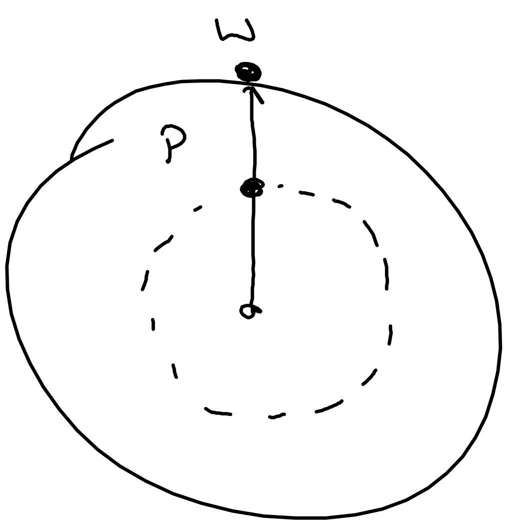
$$T = \frac{2\pi r}{v} \Rightarrow v = \frac{2\pi r}{T}$$

$$a_c = \frac{v^2}{r} = \frac{1}{r} v^2 = \frac{1}{r}\left(\frac{2\pi r}{T}\right)^2 = \frac{4\pi^2 r}{T^2}$$

$$\frac{a_w}{a_p} = \frac{\frac{4\pi^2 r_w}{T^2}}{\frac{4\pi^2 r_p}{T^2}} = \frac{r_w}{r_p} = \frac{3m}{2m} = 1.5$$

$a_w = 1.5\, a_p$ so $\vec{a}_w = (1.5 \cdot 2)\hat{i} + (1.5 \cdot 4)\hat{j}$

$$= \boxed{3\hat{i} + 6\hat{j}} \text{ in } m/s^2$$



(93) $a_c = 3.0 \times 10^{14}$ m/s^2

15 cm = 0.15 m

$a_c = \frac{v^2}{r} \Longrightarrow v = (a_c r)^{1/2}$

$= \left[(3 \times 10^{14})(0.15)\right]^{1/2} = 6708203.932$ m/s

(a) or 6.708×10^{6} m/s

(b) $T = \frac{2\pi r}{v} = \frac{2\pi(0.15)}{6.708 \times 10^{6}} = 1.405 \times 10^{-7}$ s

$= 140.5$ ns

Homework

HRW chapter 4

Questions: 11 (12) 12 (13) 13 (11)

Problems: 67 (53) 83 (67) 92 (88) 104 (115)

READ 4-8