Condition for true rolling

* True rolling occurs only when the direction of the motion of the Vehicle is perpendicular to the wheel axis

* The wheel is subjected to forward force, ~~when the~~

* When the wheel is subjected to side force that acts parallel to the wheel axis, a true skrub action is produced.

* When the wheel is subjected to both forward and side forces, the movement is compounded of true rolling and lateral distortion -

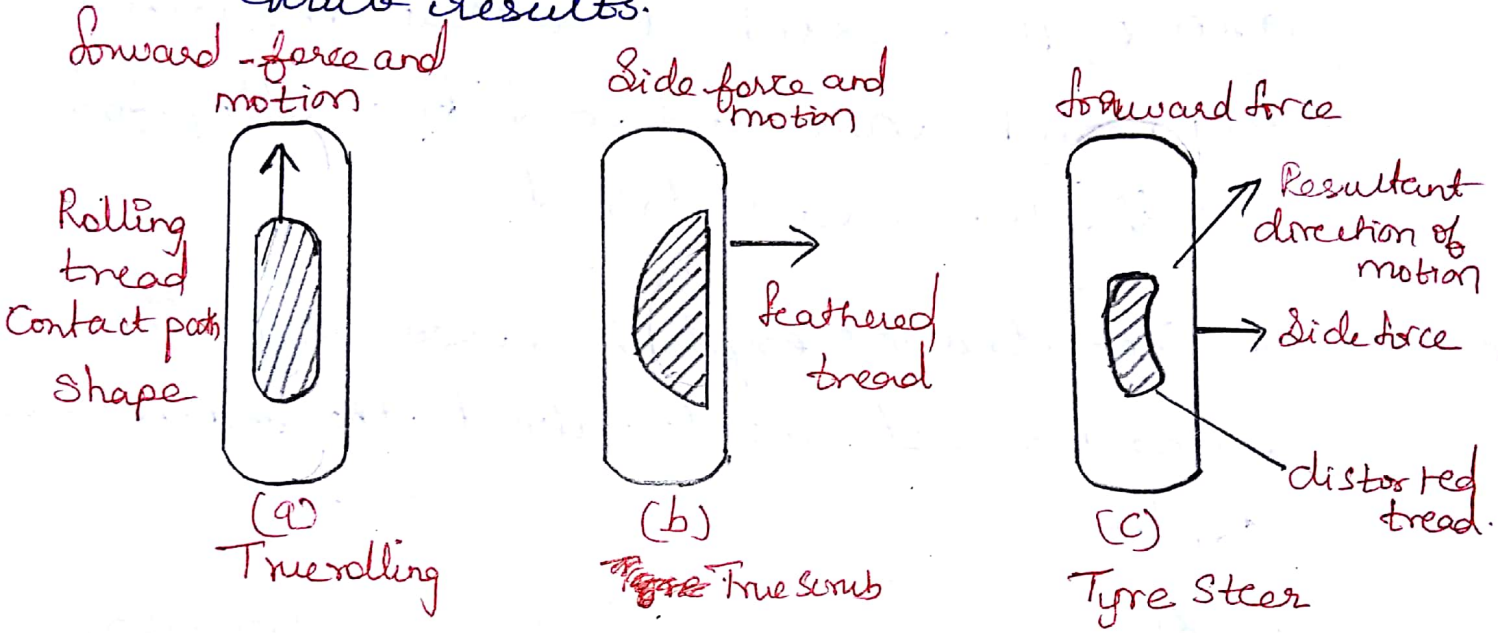
* This condition occurs, when the wheels are being steered, the direction of motion is neither parallel nor perpendicular to the axis of rotation.

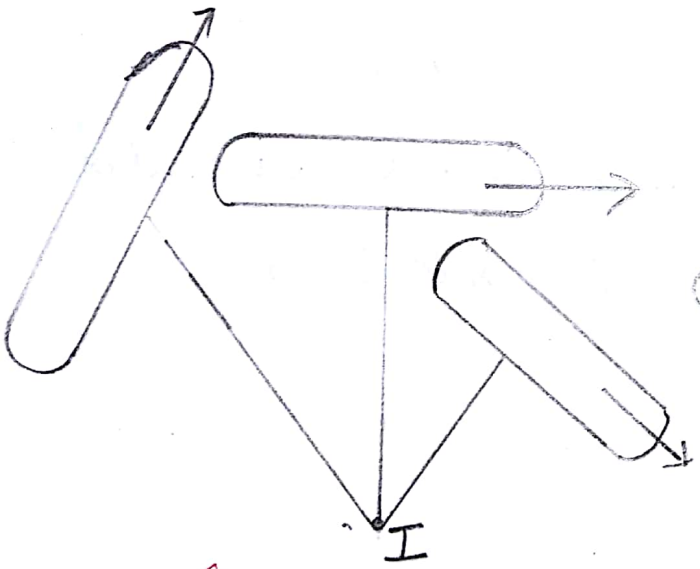
* On a circular path, true rolling condition occurs when the projected axis of several wheels all moving in different curved.

(8) → (9)

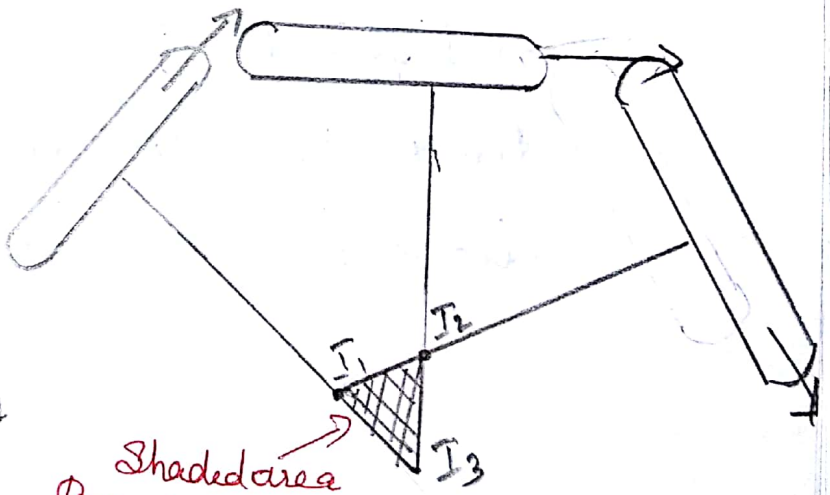
Path intersect at a single point called the instantaneous centes.

* When this projectile axis do not intesseit at a single point, a degree of tyre Scrub results.





Instantaneous centes
(d)
Condition for truerolling



(e)
Condition for true scrub

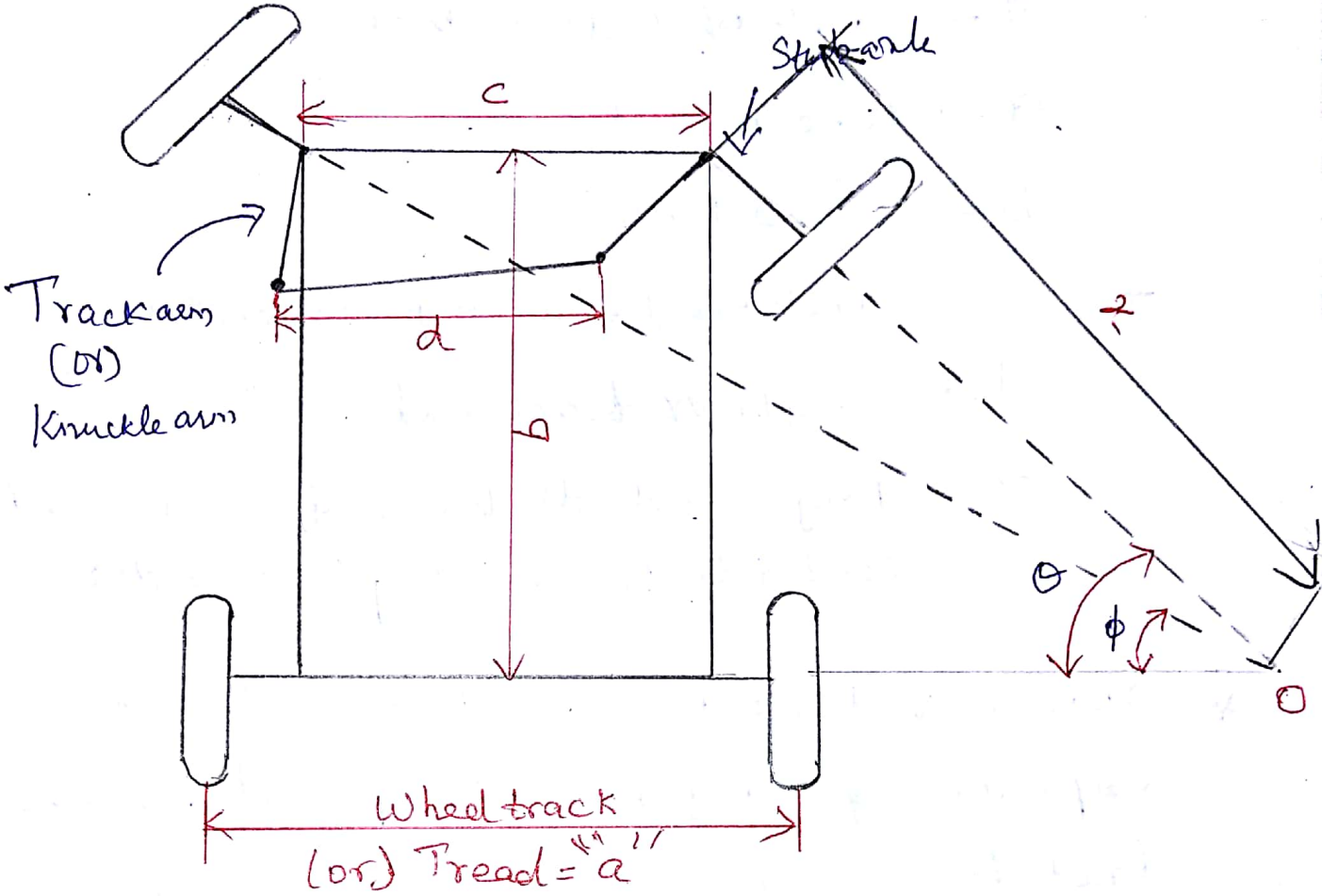
Turning circle radius

* When ever a vehicle takes a turn, the front wheel must turn in a definite manner, both in relation to each other and to the axis of the rear wheel so that the lateral slip may be avoided and true rolling for all the wheels is obtained.

* For this as explained below, all the wheel must rotate about the Instantaneous Center.

* Since the rear wheels have a common and fixed axis, it is quite obvious that this common center 'O' would lie somewhere on its extension.

(2) → (10)



from the figure

$$\cot\phi = \frac{c+x}{b} = \frac{c}{b} + \frac{x}{b}$$

$$\cot\phi = \frac{c}{b} + \cot\theta$$

$$\cot\phi - \cot\theta = \frac{c}{b}$$

where,

$\theta \rightarrow$ Angle of Inside lock

$\phi \rightarrow$ Angle of outside lock

$a \rightarrow$ Wheel track

$b \rightarrow$ Wheel base

$c \rightarrow$ distance between pivot centres

$d \rightarrow$ Length of track rod

$x \rightarrow$ Projected distance from instantaneous center to the inner pivot center

* When a vehicle takes a turn without experiencing any lateral slip, all the wheels rotate about a common center along different turning circles

* Turning circle radius of outer front wheel

$$R_{of} = \frac{b}{\sin\phi} + \frac{a-c}{2}$$

* Turning circle radius of Inner front wheel

$$R_{if} = \frac{b}{\sin\theta} - \frac{a-c}{2}$$

* Turning circle radius of outer rear wheel

$$R_{or} = b \cot \phi + \frac{a-c}{2}$$

* Turning circle radius of inner rear wheel

$$R_{ir} = b \cot \theta - \frac{a-c}{2}$$