

Greig Western

M4X00394

Vehicle Tech Exam

14/5/20

Online submission

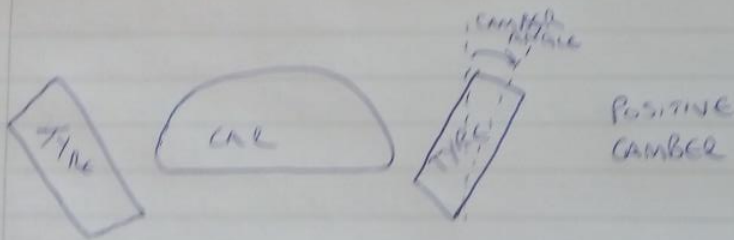
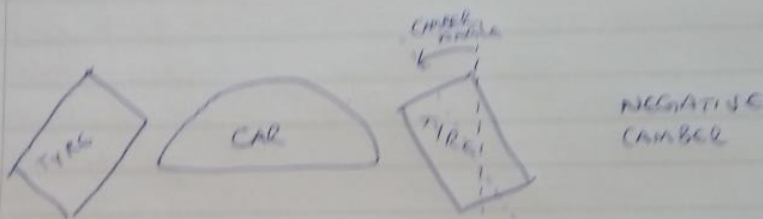
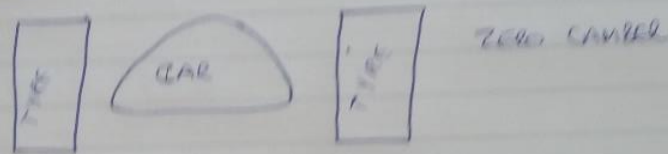
Need to write 20 words here to send via moodle so ill keep going a bit.

$$\frac{39,5}{40}$$

Outstanding
Greig

GLENN WESTERN
VEHICLE TECHNOLOGY EXAM
14/5/20
M4X00394.

1. CAMBER VIEW FROM FRONT OF VEHICLE.



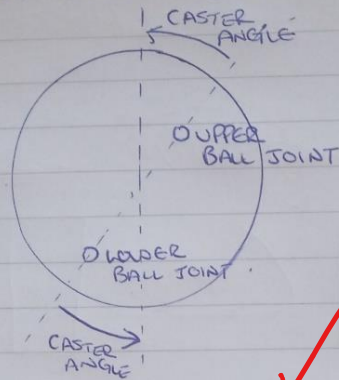
CAMBER IS THE LEAN OF THE TYRES AS PER THE ABOVE DIAGRAMS. CAMBER CAN BE USED TO COMPENSATE FOR LOAD TRANSFER AND SUSPENSION MOVEMENT DURING CORNERING OR LONGITUDINAL CHANGES. THE ANGLE CREATES CAMBER THRUST $\frac{1}{2}$ INCREASING GRIP IN THE TYRE UNTIL THE OVERALL GRIP REDUCES AS THE CONTACT PATCH REDUCES. $\frac{1}{2}$

2

(2)

CASTER ANGLE

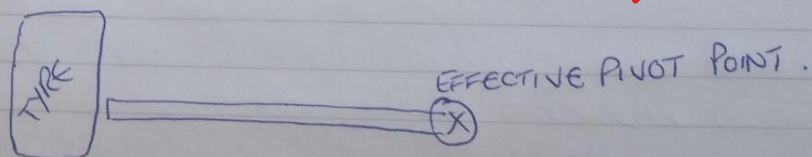
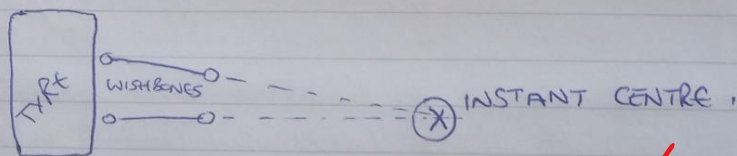
FROM SIDE VIEW OF WHEEL.



CASTER IS THE ANGLE OF LEAN FROM VERTICAL OF THE TOP + BOTTOM BALL JOINTS. THE WHEEL TURNS ABOUT THIS AXIS. INCREASED ANGLE GIVES BETTER SELF CENTREING BUT ALSO INCREASES STEERING WEIGHT. ✓ 2

INSTANT CENTRE.

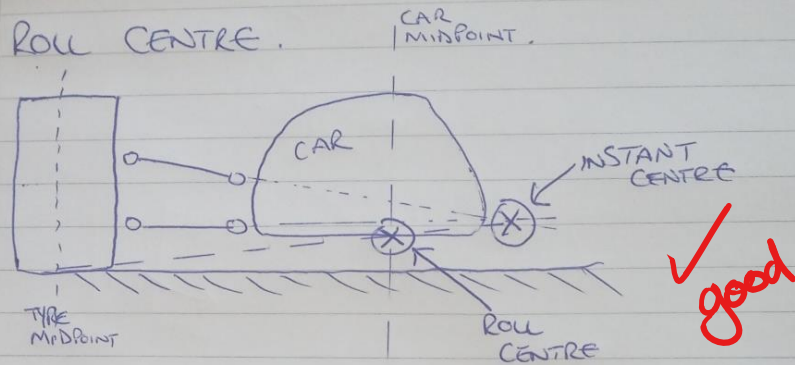
VIEW FROM FRONT OF VEHICLE.



IC IS THE INSTANTANEOUS EFFECTIVE PIVOT POINT OF THE SUSPENSION. LONGER PIVOT POINTS REDUCE CAMBER

(3)

CHANGE IN BUMP AND VICE VERSA ✓ SCRB IS
ALSO INCREASED WITH LOW OR HIGH INSTANT
CENTRE. ✓ 3



THE ROLL CENTRE IS TAKEN FROM THE INSTANT CENTRE
TO THE CENTRE POINT OF THE TYRE WHERE IT MEETS
THE GROUND, WHERE THIS LINE INTERSECTS THE
CENTRELINE OF THE CAR IS THE ROLL CENTRE.
HIGH ROLL CENTRE REDUCES BODY ROLL BUT
INCREASES JACKING. ✓ LOW ~~ROLL~~ ROLL CENTRE
INCREASES BODY ROLL AND REDUCES JACKING. ✓ 3

2. $m = 915 \text{ kg}$
 $r = 130 \text{ m}$
 $v = 25 \text{ m/s}$
 $\text{C of } g = 0.375 \text{ m}$
 $t = 1.16 \text{ m}$
 $w = 2.65 \text{ m}$

~~$ma = \frac{mv^2}{r}$~~ $\therefore m \left(\frac{v^2}{r} \right) = a$

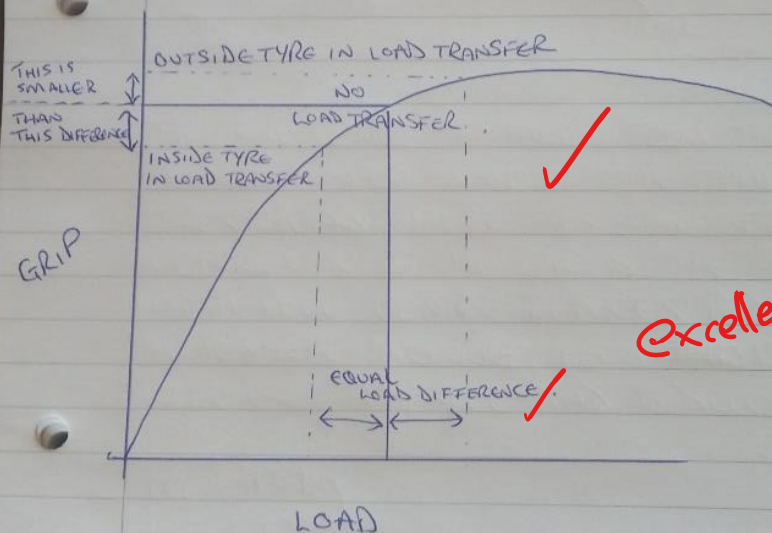
$\therefore a = \frac{v^2}{r} = \frac{25^2}{130} = 4.81 \text{ m/s}^2$ ✓ ✓ 2

(4)

i) $\frac{mah}{E} = \frac{915 \times 4.81 \times 0.375}{1.16} = 1422.79 \text{ N}$

3

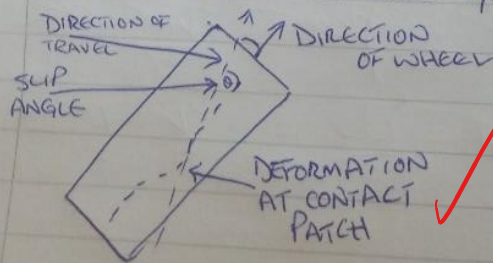
iii) DUE TO THE FACT THAT THE RATIO OF GRIP VS LOAD APPLIED IS NON LINEAR IN FASHION, FOR ANY EXTRA GRIP ACCUMULATED BY THE TYRE WITH INCREASED LOAD THERE IS A LARGER LOSS IN GRIP FROM THE TYRE WITH LESS LOAD APPLIED.



3

Excellent.

iv) SLIP ANGLE IS THE ANGLE OF THE TRAVELLING DIRECTION OF THE VEHICLE IN COMPARISON TO THE DIRECTION THE WHEEL IS POINTING DUE TO THE DEFORMATION OF THE CONTACT PATCH OF THE TYRE.



2

(5)

3.

i. $M_s = 215 \text{ kg}$
 $k_1 = 13000 \text{ N/m}$
 $k_2 = 28000 \text{ N/m}$

SERIES FIRST.

$$\frac{1}{k} = \frac{1}{k_1} + \frac{1}{k_2} = \frac{1}{13000} + \frac{1}{28000}$$
$$= \frac{41}{344000} \quad \therefore k = \frac{1}{\frac{41}{344000}}$$

$$\therefore k = 8878.05 \text{ N/m} \quad \checkmark$$

PARALLEL.

$$k = k_1 + k_2$$

$$k_1 = k_2$$

$$\therefore k = 8878.05 \times 2 = 17756.1 \text{ N/m} \quad \checkmark$$

3

ii) $\omega_n = \sqrt{\frac{k}{m}}$

$$\therefore f_n = \frac{\omega_n}{2\pi} = \frac{1}{2\pi} \sqrt{\frac{k}{m}} \quad \checkmark$$

$$\therefore = \cancel{1.45 \text{ Hz}} \quad 1.45 \text{ Hz} \quad \checkmark$$

2

iii) THIS VALUE FALLS BETWEEN WALLOW MOTION ($0.7 - 1 \text{ Hz}$) AND HARSH RIDE ($2 - 2.5 \text{ Hz}$), THIS SUGGESTS IT WOULD BE JUST RIGHT FOR THE LONG TRAVEL OF AN OFF ROADER WHICH DOES NOT WANT TO WALLOW TOO MUCH BUT ALSO DOES NOT NEED TO BE STIFF, TO ABSORB LARGER BUMPS. $\checkmark$

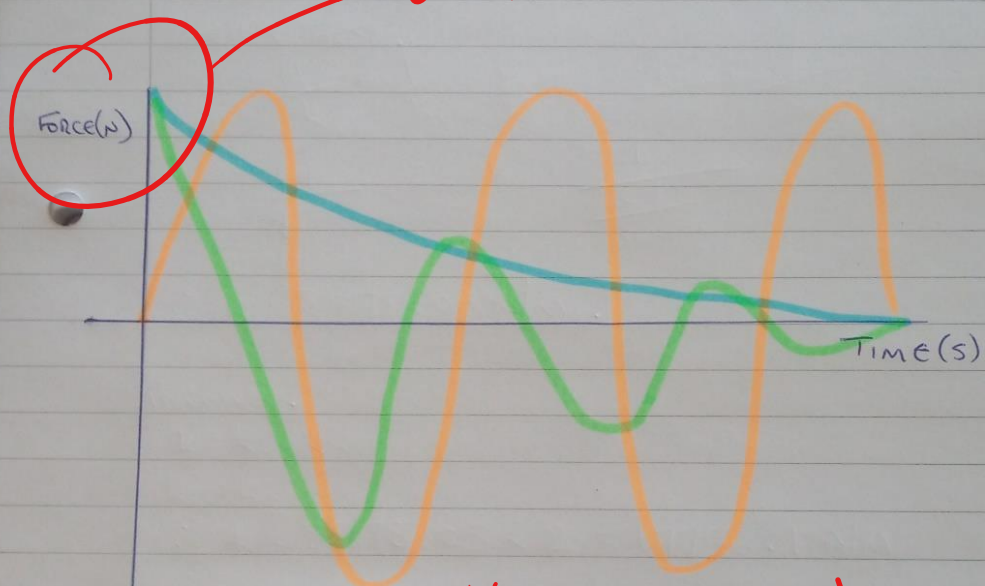
Excellent! $\checkmark$

2

6

iv)

displacement



- UNDAMPED $\frac{1}{2}$ ✓
- UNDER DAMPED ✓
- OVER DAMPED ✓

excellent!

2,5

⑦

$$\begin{aligned} 4. \quad m &= 875 \text{ kg} \\ a &= -7.5 \text{ m/s} \\ \omega_c &= 100\% \\ \text{PEDAL RATIO (PR)} &= 4:1 \\ \text{MC } \phi &= 15.875 \text{ mm} \\ \text{SC } \phi &= 44.45 \text{ mm} \\ n &= 2 \\ r &= 0.15 \text{ m} \\ \mu &= 0.42 \\ R &= 0.285 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{i) } F &= ma \\ &= 875 \times 7.5 = 6562.5 \text{ N} \end{aligned}$$

$$\text{ii) } F_w = \frac{6562.5}{2} = 3281.25 \text{ N}$$

$$T = F_w \times R = 3281.25 \times 0.285 = 935.16 \text{ N/m}$$

$$F_s = \frac{T}{\mu r} = \frac{935.16}{0.42 \times 0.15} = 14843.81 \text{ N}$$

$$P = \frac{F_s}{A_s \times n} = \frac{14843.81}{\pi \left(\frac{0.04445}{2} \right)^2 \times 2} = 4782797.341 \text{ N/m}^2$$

$$F_p = \frac{P \times A_m}{PR} = \frac{4782797.341 \times \pi \left(\frac{0.015875}{2} \right)^2}{4}$$

$$= F_p = 236.67 \text{ N}$$