



Complete, fold and seal
(see note 2 below)

SURNAME: Bridgeland

FORENAME(S): Jack

12 Pages

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either ignore illegible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. **Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.**

[illegible]



Q1 mass = 1170 kg
 mass disp ~~58%~~ 58% front
 max engine = 225 kw 42% rear
 wheelbase = 2718 mm 2.718 m
 225×10^3 yaw inertia = 1300 kg m²

a) $1170 \times 0.58 = 678.6$ kg
 $2718 \div 100 = 27.18$
 $27.18 \times 58 = 1576.44$ from front axle
 $2718 - 1576.44 = \underline{\underline{1141.56 \text{ mm}}}$

b) $I = A x^2$ $H = 1.142$

$C = I_{22} / m \times a$

$= \frac{1300}{1170 \times 1.142 \times 0.97}$

$= \frac{1300}{1170 \times 1.142 \times 0.97}$
 $= 0.97$

c) $I = m k^2$
 $1300 = 1170 \times k^2$
 $\frac{1300}{1170} = k^2$
 $k = \sqrt{\frac{1300}{1170}}$

$k = 1.05$

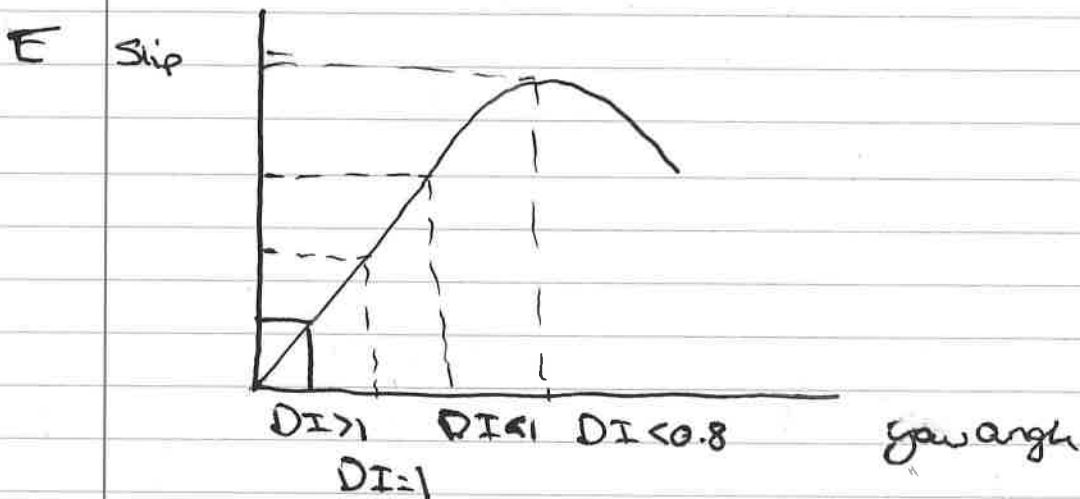
d) $DI = \frac{\text{inertia}}{m \times a \times b}$
 $= \frac{1300}{1170 \times 1.142 \times 1.58}$

$DI = 0.62$

24/10/2020
 D cent) $DI = 0.62$

~~$DI = 1$ DI is on the rear axle
 Stable and less responsive~~
 ~~$DI > 1$ not very responsive~~

$DI < 0.8$ which is very low
 Vehicle will be very unstable
 and hard to control



$DI = 1$ DI is on the rear wheels
 The vehicle will be stable
 but slow to turn in

$DI > 1$ vehicle will be sluggish on turn
 in but stable at speed

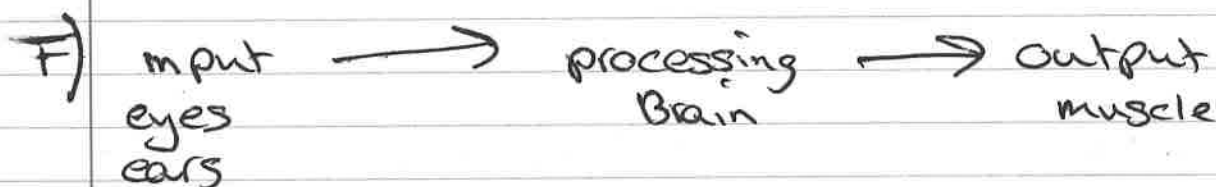
$DI < 1$ vehicle will be fast and responsive
 To steering input unstable at
 speed can be hard to control

$DI < 0.8$ vehicle will be very responsive
 and hard to control



force on rear wheels
more with lower DI
creating a higher slip
angle making it likely
to wash out forester

2/4



input $\rightarrow$ relies on eyes and ears to send
a signal to the brain which
~~costs~~ has a delay

processing $\rightarrow$ Brain $\rightarrow$ has to analyse
incoming data and decide on an
action which increases time

$\rightarrow$ output $\rightarrow$ muscle $\rightarrow$ muscles have a
response time to react after
receiving a signal from the
brain

1 1/2
2

All of these time delays will effect
The response of the driver and their
perception

g $DI = 0.87$

original 1300
final = 1850

$1850 - 1300 = 550$ Difference ✓

1) $I = mk^2$

1/3

2) $DI = \frac{I}{mab}$
 $0.87 = \frac{1850}{m \times 1.142 \times 1.58}$

$0.87 = \frac{1850}{1.8m}$
 $0.87 \times 1.8m = 1850$

$m = \frac{1850}{0.87 \times 1.8} = 989.8 \text{ kg}$

~~$DI = \frac{I}{mab}$~~
 ~~$DI \times mab = I$~~
 ~~$DI mab = I$~~

$DI = \frac{I}{mab}$

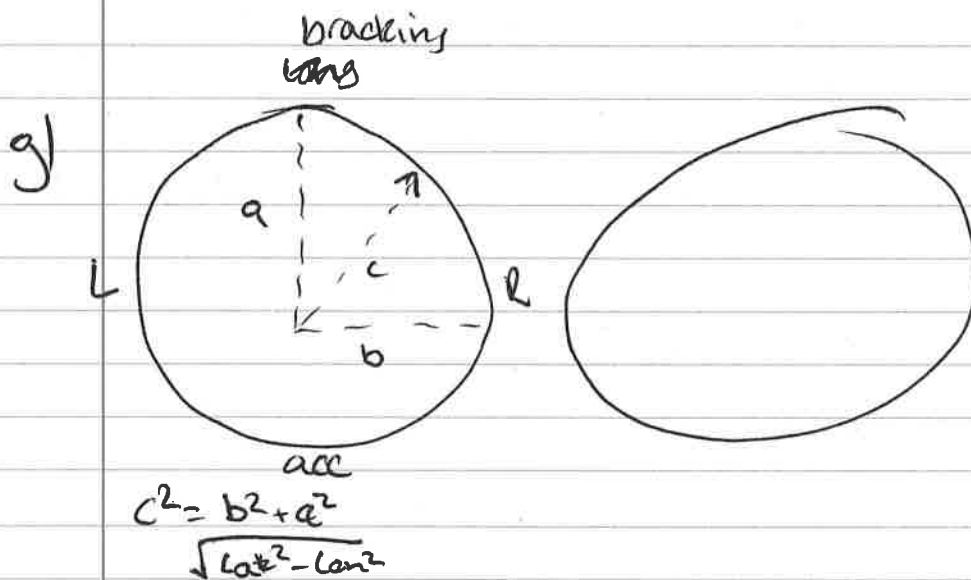
$MDI = \frac{I}{ab}$

$m = \frac{I}{abDI}$

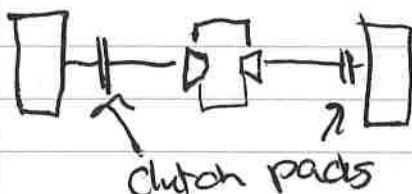
~~1850~~ $\frac{1850}{0.87 \times 1.8}$

0/3

12/20



- h) with a different diff $T_1 \neq T_2$
 and different amounts of torque
 can be applied T_2 outside wheel
 has extra grip than the inside
 wheel. So with an open diff the
 inside wheel is the limiting factor.
 So the maximum grip on the outside
 tire is wasted with a torque vectoring
 diff more ^{large} force can be applied to
 the outside to utilise the wasted
 grip creating a larger drive force.



~~GLA # PCDA 43 P 12 S11PK~~
~~0.5 x 1.2 x 3 x 0.8 x~~

The clutch packs within the diff can limit the amount of torque supplied to each wheel

4
20

Question No.

Examiner Only

Arholwr yn unig

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