



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.**

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FORENAME(S): Paul Simon

1	Student Number	D150613
2	Title of Examination Paper	~~MSX~~ CAE Stress
3	Module Code	MSX02064
4	Date and Time of Examination	9/5/19
5	Examination Venue	IQ 310
6	Seat Number	G035
7	Number of Answer Books handed in	1

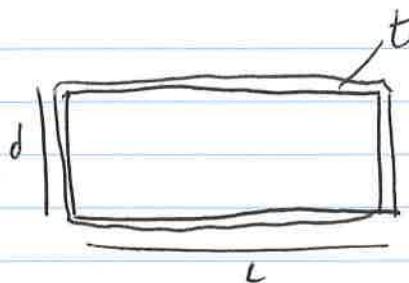
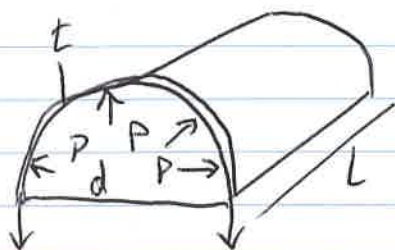
[illegible]

(Gweler yr ochr arall am y fersiwn Cymraeg)

66.7)

1)

A



forces due to hoop strength:

$$2\sigma_H tL$$

forces due to pressure:

~~$$F = PA$$~~
$$P = \frac{F}{A} \rightarrow F = PA \quad A = d \times L$$

$$\therefore \underline{F = PdL}$$

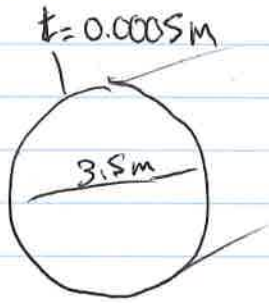
$$2\sigma_H tL = PdL$$

$$\sigma_H = \frac{Pd}{2t}$$

$$\therefore \underline{\sigma_H = \frac{Pd}{2t}}$$

1/4

B)



$$\sigma_{H_{\max}} = 200 \text{ mpa}$$

1)

$$\sigma_H = \frac{pd}{2t} \rightarrow \frac{\sigma_H 2t}{d} = p$$

$$\therefore \frac{(200 \times 10^6) \times 2 \times 0.0005}{3.5} = 57142.86 \text{ pa}$$

$$\text{or } 57.142 \text{ kpa}$$

$$S_0 = 20000 \text{ ft}$$

ii) @ 8000 ft, $p = 75.3 \text{ kpa}$

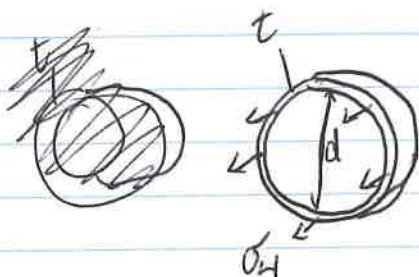
$$\therefore \begin{array}{r} 75300 \\ - 57142 \\ \hline 18158 \end{array}$$

$$\sigma_H = \frac{18158 \times 3.5}{2 \times 0.0005} = 63.553 \times 10^6$$

$$S_0 = 150000 \text{ ft}$$

- c) Pressurising plane cabins allows them to fly higher, which allows them to fly faster and use less fuel as the air is thinner.

d)



Force due to pressure : $F = pA$

$$A_{\text{cross section}} = \frac{\pi d^2}{4}$$

$$A = \frac{\pi d^2}{4}$$

$$F = p \frac{\pi d^2}{4}$$

Force due to hoop: ~~force~~ ~~due to~~

$$\sigma_H \pi d t = \frac{p \pi d^2}{4}$$

$$\sigma_H \pi d t = \frac{p \pi d^2}{4}$$

$$\therefore \sigma_H = \frac{p \pi d^2}{4 \pi d t}$$

$$\sigma_H = \frac{p d}{4 t}$$

- e) depending on the liquid stored it may need to be stored under pressure, a ~~given~~ spherical container can store liquids/gasses at ~~2x~~ higher pressure than a cylinder as ~~as~~ a sphere doesn't have a longitudinal stress, the down side is cylinders can carry more volume than a sphere,

(3)

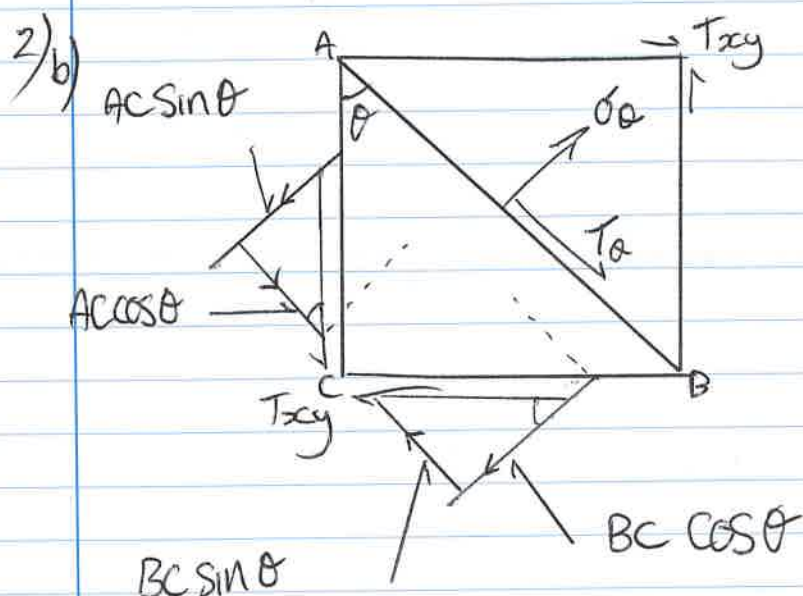
2)

- 4) ~~Principal stress is stress acting along the ~~xy~~ ~~z~~ of~~

Principal stress is the component of stress acting on the object in question

Principal plane is the direction the stress is acting along either the x or y axis.

(2)



$$\begin{array}{l} S \frac{O}{H} \frac{BC}{AB} \\ C \frac{A}{H} \frac{AC}{AB} \\ T \frac{O}{A} \frac{BC}{AC} \end{array}$$

acting perpendicular to σ_θ :

$$AB \sigma_\theta = AC \sin \theta + BC \cos \theta$$

$\div AB$

$$\sigma_\theta = \frac{AC}{AB} \sin \theta + \frac{BC}{AB} \cos \theta$$

$$\begin{aligned} \sigma_\theta &= \cos \theta \sin \theta T_{xy} + \sin \theta \cos \theta T_{xy} \\ &= \cos \theta (\sin \theta T_{xy}) + \sin \theta (\cos \theta T_{xy}) \\ &= \frac{1}{2} \sin 2\theta (T_{xy}) + \frac{1}{2} \sin 2\theta (T_{xy}) \end{aligned}$$

$$\sigma_H = \sin 2\theta T_{xy}$$

$$\sigma_H = \underline{T_{xy} \sin 2\theta}$$



Resolve parallel to $T\theta$: $\leftarrow = \rightarrow$

$$BC T_{xy} \sin \theta = AB T_{\theta} + AC T_{xy} \cos \theta$$

$$\frac{AB T_{\theta}}{AB} = \frac{AC T_{xy} \cos \theta}{AB} - \frac{BC T_{xy} \sin \theta}{AB}$$

$$T_{\theta} = \frac{AC}{AB} T_{xy} \cos \theta - \frac{BC}{AB} T_{xy} \sin \theta$$

$$= \cos \theta T_{xy} \cos \theta - \sin \theta T_{xy} \sin \theta$$

$$= \cos^2 \theta T_{xy} - \sin^2 \theta T_{xy}$$

$$= -\cos 2\theta (T_{xy})$$

$$\underline{T_{\theta} = -T_{xy} \cos 2\theta}$$

(5)

Q3
A

design problems ~~are~~ can be solved in multiple ways to fit a requirement; Whereas analysis problems usually require 1 solution to a specific part of a problem

/ (3)

design problems can be solved ~~again~~ with renewed iterations if the previous ~~step~~ design doesn't solve the problem; Where as an ~~analysis~~ analysis problem needs to be solved then the rest of the problem can be worked out, carrying through the solution.

For example: a pen can be designed many ways to carry out the same function, a small pen, large pen, thick pen, thin pen all do the same thing.

but if the pen doesn't write then you must ask why the pen isn't working, analysing it for problems such as an ink blockage, which must be addressed before moving on to see if the ball point is working.

/ (5)

c) 5 steps:

- 1) identify problem
 - customer needs
 - is it a genuine problem
 - is it worth fixing
- 2) ~~look~~ look at current solutions - has any one else fixed
 - is the current fix good enough
 - can I do it better
- 3) brainstorm ideas + solutions
 - Generate a list of possible solutions
 - involve outsiders to give fresh perspective

→

4/ analyse + select - analyse ideas and pick one final solution

5) test solution - real world conditions test
- is it worthy?

3

Question No.

Examiner Only

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Examiner Only

Arholwr yn unig

Rhif y Cwestiwn

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Arholwr yn unig

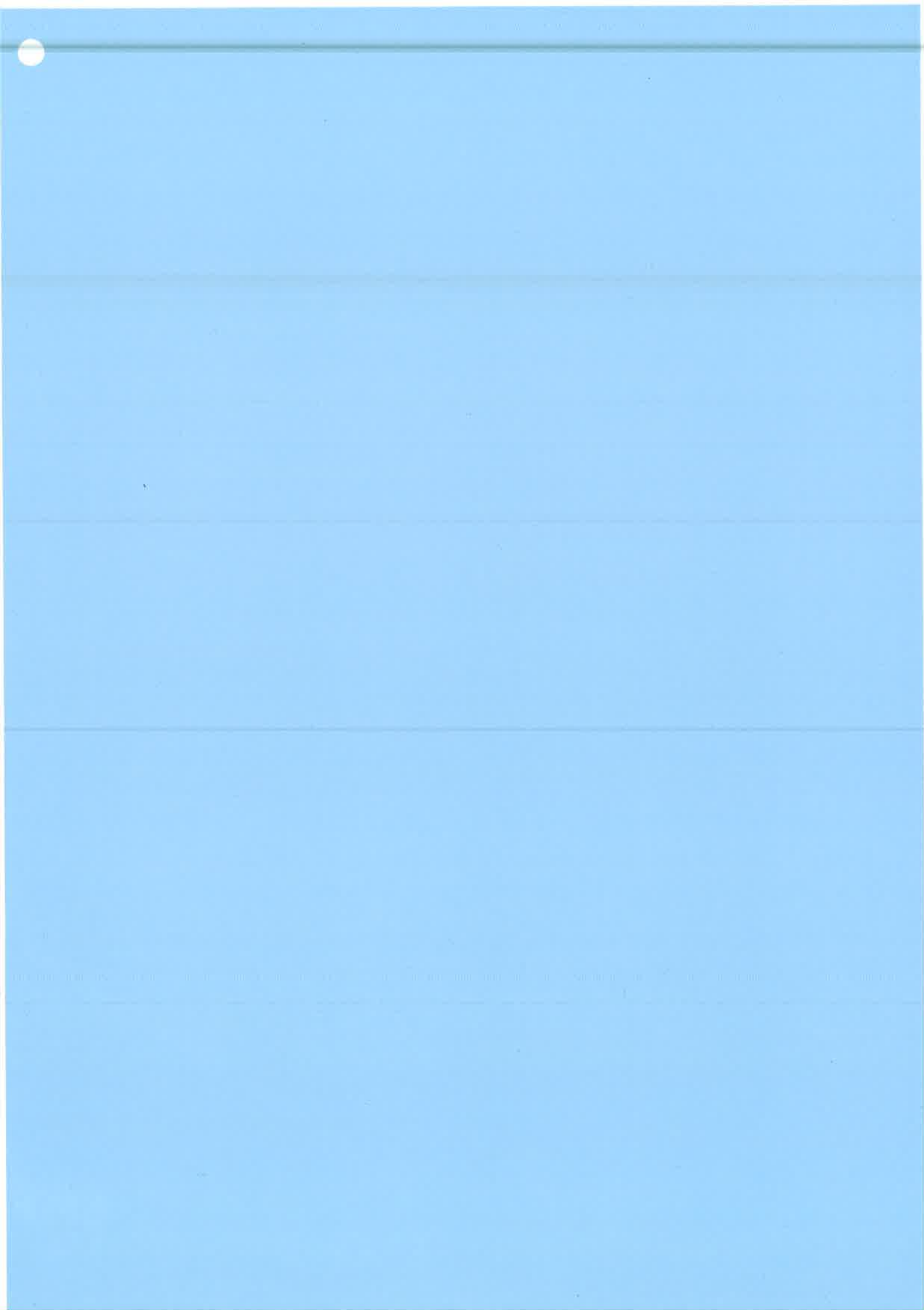
Rhif y Cwestiwn

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Arholwr yn unig

rhif y Cwestiwn



8. Rhaid dychwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

7	Nifer y Llyfrau Atebion a gyflwynwyd	
6	Rhif Sedd	
5	Lleoliad yr Arholiad	
4	Dyddiad ac Amser yr Archoliad	
3	Cod y Modwl	
2	Teitl y Papur Arholiad	
1	Rhif Myfyrwr	

[illegible]

(See the other side for English version)

Llenwch, plygwch a seliwch
(gweler nodyn 2 isod)

CYFENN:

ENW(AU) CYNTAF:

ENW(AU) CYNTAF: