

**Complete, fold and seal
(see note 2 below)**

SURNAME:

Bowen

FORENAME(S):

DAVID,

LUKE.

Examination Answer Books

12 Pages

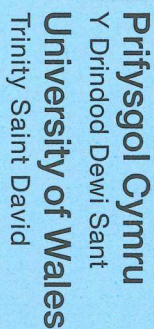
Instructions to Candidates

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.**

List the numbers of the questions you have attempted	Office Use
Total	64%

1	Student Number	133872
2	Title of Examination Paper	ENGINEERING MATHEMATICS
3	Module Code	SAFE 4002
4	Date and Time of Examination	09:30 13/05/2024
5	Examination Venue	G43 COLLEGE SIN CAR.
6	Seat Number	
7	Number of Answer Books handed in	

(Gweler yr ochr arall am y fersiwn Cymraeg)



Llyfr Atebion Arholiadau

12 Tudalen

Cyfarwyddiadau i Ymgeiswyr

1. Rhowch yr holl wybodaeth y gofynnir amdani yn y blychau isod.
2. Rhowch eich enw yn y lle a ddarparwyd ar y dde, plygwch ef a'i selio i lawr (gan ddefnyddio'r label a ddarparwyd) i guddio'ch enw.
3. Rhaid i'r atebion fod mewn llawysgrifen ddarlennadwy. Gall yr Arholwyr naill ai anwybyddu sgrïpt annarlennadwy, neu drefnu icdi gael ei theipio a chael yr ymgesydd i dalu.
4. Ysgrifennwch eich atebion mewn inc.
5. Dechreuwch bob ateb ar dudalen newydd. Gwnewch unrhyw fräs nodiadau yn y llyfr atebion a thynnu llinell drwyddynt.
6. Ni ddylid rhwygo unrhyw ran o'r llyfr hwn; rhaid ei gyflwyno yn gyfan.
7. Os defnyddir mwy nag un llyfr, rhwymwch hwy gyda'i gilydd gan ddefnyddio'r tagiau sydd ar gael oddi wrth y gwyliwr/gwyliwyr.
8. Rhaid dyrchwelyd pob llyfr. Ni chaniateir mynd â llyfrau atebion, wedi eu defnyddio neu heb eu defnyddio, allan o'r lleoliad arholi o dan unrhyw amgylchiadau.

Llenwch, plygwch a seliwch (gweler nodyn 2 isod)

CYFENW-

ENW(AU) CYNTAF:

ENW(AU) CYNTAF:

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

[illegible]

(See the other side for English version)

$$V^2 = u^2 + 2as, a$$

$$1) \quad V^2 - u^2 = 2as$$

$$a = \frac{V^2 - u^2}{2s}$$

$$b) \quad V = \frac{V_0}{\sqrt{r^2 - 1}}, r.$$

$$\frac{V_0}{V} = \sqrt{r^2 - 1}.$$

$$\left(\frac{V_0}{V}\right)^2 = r^2 - 1.$$

$$\left(\frac{V_0}{V}\right)^2 + 1 = r^2$$

$$r = \sqrt{\left(\frac{V_0}{V}\right)^2 + 1}$$

$$2a) \quad (x^2)^3 = x^6$$

$$b) \quad \frac{y^6}{y^2} = y^4$$

$$3a) \quad 7x^3y + 14x^2y = 7x^2y(x+2)$$

$$b) \quad 12x^4y^2 + 9x^3y^2 = 3x^3y^2(4x+3)$$

$$c) \quad x^2 + 8x + 15 = (x+5)(x+3)$$

$$d) \quad x^2 + 13x + 22 = (x+11)(x+2)$$

a b c

$$49) 4x^2 + 3x - 7 = 0$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$= \frac{-3 \pm \sqrt{3^2 - 4(4)(-7)}}{2(4)}$$

$$= \frac{-3 \pm \sqrt{9 + 112}}{8}$$

$$= \frac{-3 \pm \sqrt{121}}{8}$$

$$= \frac{-3 \pm 11}{8}$$

$$x = \frac{-3 - 11}{8} \quad \text{OR} \quad x = \frac{-3 + 11}{8}$$

$$x = \frac{8}{8}$$

$$= \frac{14}{8}$$

$$x = \frac{7}{4}$$

$$x = 1.75$$

3

a b c

$$b) (3)x^2 - 16x - 12$$

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$x = \frac{-(-16) \pm \sqrt{-16^2 - 4(3)(-12)}}{2(3)}$$

$$x = \frac{16 \pm \sqrt{256 - 144}}{6}$$

$$x = \frac{16 \pm \sqrt{112}}{6}$$

$$x = \frac{16 \pm 10.5}{6}$$

$$x = \frac{16 + 10.5}{6} \quad \text{OR} \quad x = \frac{16 - 10.5}{6}$$

$$x = \frac{26.5}{6}$$

$$x = \frac{16 \pm \sqrt{400}}{6}$$

$$x = \frac{16 \pm 20}{6}$$

$$x = \frac{16 + 20}{6} \quad \text{OR} \quad x = \frac{16 - 20}{6}$$

$$x = \frac{36}{6}$$

$$x = \frac{-4}{6}$$

$$x = 6$$

$$x = -0.66$$

6a) $(A+B) = (12+j6) + (14-j3)$
 $= (26+j3)$ _{rec} or $26.1 \angle 6.5^\circ$ _{pol.}

b) $(B-C) = (14-j3) - (10+j4)$
 $= (4-j7)$ _{rec} or $8 \angle -60.2^\circ$ _{pol.}

c) $(A \times B) - C$

$= (12+j6)(14-j3)$

convert to pol

$= 13.4 \angle 26.5^\circ \times 14.3 \angle -12^\circ$

$= 192 \angle 14.5^\circ$ or $186 + j48$ _{rec.}

(check in cartesian)

$168 - 36j + 84j - 18j^2$

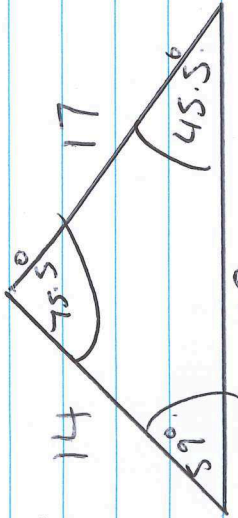
$= 168 + 48j + 18$

$= 186 + 48j$ ✓

$(A \times B) - C = (186 + 48j) - (10 + j4)$

$= 176 + 44j$ _{rec.} or $181.4 \angle 14^\circ$ _{pol.}

7b MORE
7a IS NEXT PAGE.



$a^2 = b^2 + c^2 - 2bc \cos A$
 $\cos A = \frac{b^2 + c^2 - a^2}{2bc}$

$\cos A = \frac{17^2 + 19^2 - 14^2}{2(17)(19)}$

$\cos A = \frac{289 + 361 - 196}{646}$

$\cos A = 0.7$

$A = \cos^{-1}(0.7)$

$A = 45.5^\circ$ ✓

$\frac{\sin A}{a} = \frac{\sin B}{b}$

$\sin A = a \frac{\sin B}{b}$

$\sin A = 19 \frac{\sin 45.5^\circ}{14}$

$\sin A = 0.96$

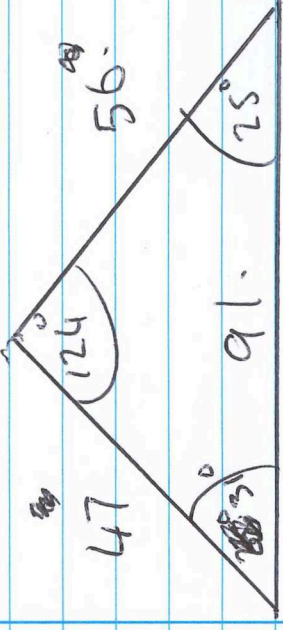
$A = \sin^{-1}(0.96)$

$A = 75.5^\circ$ ✓

$180 - 75.5 - 45.5 = 59^\circ$

$A = 59^\circ$ ✓

7a)



$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$a^2 = 47^2 + 56^2 - 2(47)(56) \cos 124$$

$$a^2 = 2209 + 3136 - 5264 \cos 124$$

$$a^2 = 8288$$

$$a = \sqrt{8288}$$

$$a = 91$$

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\sin A = a \frac{\sin B}{b}$$

$$\sin A = 47 \frac{\sin 124}{91}$$

$$\sin A = 0.42$$

$$A = \sin^{-1}(0.42)$$

$$A = 25^\circ$$

$$180 - 124 - 25 = 31$$

$$C = 31^\circ$$

10a

$$A + B$$

$$= \begin{pmatrix} 4 & 5 \\ 6 & 7 \end{pmatrix} + \begin{pmatrix} 8 & 9 \\ 10 & 11 \end{pmatrix} = \begin{pmatrix} 4+8 & 5+9 \\ 6+10 & 7+11 \end{pmatrix}$$

$$= \begin{pmatrix} 12 & 14 \\ 16 & 18 \end{pmatrix}$$

$$b) A - B = \begin{pmatrix} 4 & 5 \\ 6 & 7 \end{pmatrix} - \begin{pmatrix} 8 & 9 \\ 10 & 11 \end{pmatrix}$$

$$= \begin{pmatrix} 4-8 & 5-9 \\ 6-10 & 7-11 \end{pmatrix} = \begin{pmatrix} -4 & -4 \\ -4 & -4 \end{pmatrix}$$

$$c) A \times B = \begin{pmatrix} 4 & 5 \\ 6 & 7 \end{pmatrix} \times \begin{pmatrix} 8 & 9 \\ 10 & 11 \end{pmatrix}$$

$$= \begin{pmatrix} 4 \times 8 + 5 \times 10 & 4 \times 9 + 5 \times 11 \\ 6 \times 8 + 7 \times 10 & 6 \times 9 + 7 \times 11 \end{pmatrix}$$

$$= \begin{pmatrix} 32 + 50 & 36 + 55 \\ 48 + 70 & 54 + 77 \end{pmatrix}$$

$$= \begin{pmatrix} 82 & 91 \\ 118 & 131 \end{pmatrix}$$

$$\begin{pmatrix} 4 \times 8 & 5 \times 10 \\ 6 \times 9 & 7 \times 11 \end{pmatrix}$$

$$= \begin{pmatrix} 32 & 50 \\ 54 & 77 \end{pmatrix}$$

11) $\int \sin(5x+2) dx$

$$u = 5x+2$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$= \cos(u) \cdot 5$$

$$= 5 \cos(5x+2)$$

12) $\int x^2 e^{-x} dx$

$$u = x \quad \frac{du}{dx} = 1$$

$$v = e^{-x} \quad \frac{dv}{dx} = -e^{-x}$$

$$= (2x)(e^{-x}) - x e^{-x}$$

$$= 2x e^{-x} - x e^{-x}$$

$$= x e^{-x} (2-1)$$

13) $\int \frac{3x-4}{2x+1} dx$

$$u = 3x-4 \quad \frac{du}{dx} = 3$$

$$v = 2x+1 \quad \frac{dv}{dx} = 2$$

$$\frac{dy}{dx} = \frac{v \frac{du}{dx} - u \frac{dv}{dx}}{v^2}$$

$$= \frac{(2x+1) - 2(3x-4)}{(2x+1)^2}$$

14) $\int x \sin x dx$

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$$

$$= -\frac{1}{x^2} \cos x + C$$

5a) $\frac{(2x+5)}{(x-2)(x+1)}$

$$\frac{Px+Q}{(x-a)(x-b)}$$

$$\frac{A}{x-a} + \frac{B}{x-b}$$

b) $\frac{5x^2 + 17x + 15}{(x+2)^2(x+1)}$

$$\frac{Px^2 + Qx + R}{(x-a)^2(x-b)}$$

$$\frac{A}{x-a} + \frac{B}{x-b} + \frac{C}{x-c}$$