

1. $V = \frac{V_0}{\sqrt{r^2 - 1}}$ MAT115 EXAM

92

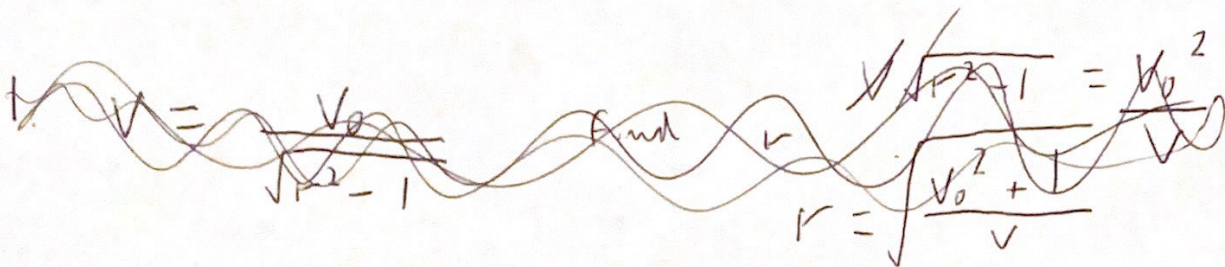
~~$\sqrt{r^2 - 1}$~~ = $\sqrt{\frac{V_0^2}{V^2} + 1}$

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

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

5

MATHS EXAM



2.

$$a) 5(3x - 2) - 2(4x - 3) + 25 = 0$$

$$15x - 10 - 8x + 6 + 25 = 0 \quad \checkmark$$

$$7x + 21 = 0 \quad \checkmark$$

$$7x = -21 \quad \checkmark$$

$$x = -3 \quad \checkmark$$

4

$$b) \overset{A}{6}x^2 + \overset{B}{13}x - \overset{C}{5} = 0$$

$$-13 \pm \sqrt{13^2 - 4 \times 6 \times -5}$$

$$2 \times 6$$

$$\frac{1}{3} \quad \text{or} \quad -\frac{5}{2}$$

5

$$c) 5 \times 10^{3x+2} = 215$$

$$10^{3x+2} = \frac{215}{5} \quad \checkmark$$

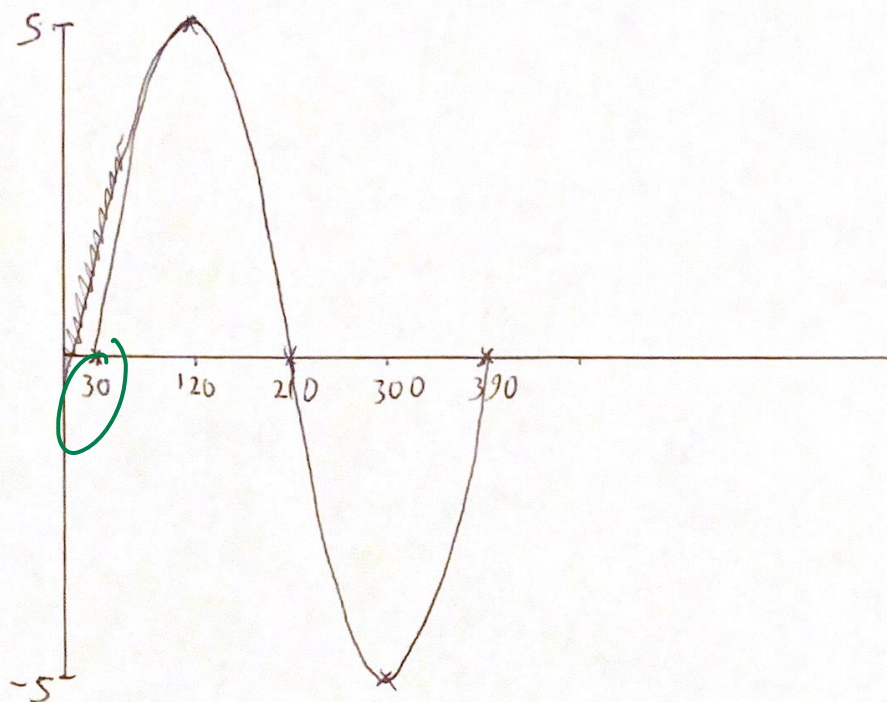
$$10^{3x+2} = 43 \quad \checkmark$$

$$3x + 2 = \frac{\log_{10}(43)}{3} \quad \checkmark$$

$$= -0.1222 \quad \checkmark$$

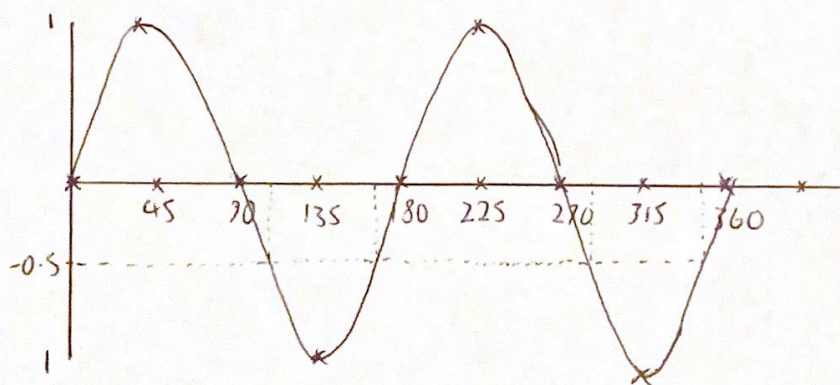
6

3. a) $y = 5 \sin(x - 30)$



3

b) $\sin 2x = -0.5$



area
105
165
285
345
units

8

$$4. Z_1 = 3 - j5 \quad Z_2 = -2 + j4$$

$$a) Z_1 - Z_2$$

$$(3 - j5) - (-2 + j4)$$

$$5 - 9j$$

2

$$b) Z_1 Z_2$$

$$(3 - j5)(-2 + j4)$$

$$-6 - 20j^2 + 12j + 10j$$

$$-6 + 20$$

$$14 + 22j$$

4

$$c) \frac{Z_1}{Z_2}$$

$$\frac{3 - j5}{-2 + j4} \times \frac{-2 - j4}{-2 - j4}$$

$$= \frac{-6 + 20j^2 + 10j - 12j}{4 - 16j^2 + 8j - 8j}$$

$$\frac{-26 - 2j}{20}$$

separate and
simplify

6

$$5. A = \begin{pmatrix} 4 & -1 \\ 2 & -3 \end{pmatrix} \quad B = \begin{pmatrix} 5 & 0 \\ -2 & 6 \end{pmatrix}$$

$$a) 3A - 2B$$

$$\begin{pmatrix} 12 & -3 \\ 6 & -9 \end{pmatrix} - \begin{pmatrix} 10 & 0 \\ -4 & 12 \end{pmatrix}$$

$$\begin{pmatrix} 2 & -3 \\ 10 & -21 \end{pmatrix} \quad \checkmark$$

3

$$b) AB$$

$$\begin{matrix} & c1 & c2 \\ R1 & \begin{pmatrix} 4 & -1 \end{pmatrix} & \begin{pmatrix} 5 & 0 \end{pmatrix} \\ R2 & \begin{pmatrix} 2 & -3 \end{pmatrix} & \begin{pmatrix} -2 & 6 \end{pmatrix} \end{matrix}$$

$$\begin{aligned} 4 \times 5 &= 20 \\ -1 \times -2 &= 2 \end{aligned}$$

$$\begin{aligned} 4 \times 0 &= 0 \\ -1 \times 6 &= -6 \end{aligned}$$

$$\begin{aligned} 2 \times 5 &= 10 \\ -3 \times -2 &= 6 \end{aligned}$$

$$\begin{aligned} 2 \times 0 &= 0 \\ -3 \times 6 &= -18 \end{aligned}$$

$$AB = \begin{pmatrix} 22 & -6 \\ 16 & -18 \end{pmatrix} \quad \checkmark$$

4

$$c) BA$$

$$\begin{matrix} & c1 & c2 \\ R1 & \begin{pmatrix} 5 & 0 \end{pmatrix} & \begin{pmatrix} 4 & -1 \end{pmatrix} \\ R2 & \begin{pmatrix} -2 & 6 \end{pmatrix} & \begin{pmatrix} 2 & -3 \end{pmatrix} \end{matrix}$$

$$\begin{aligned} 5 \times 4 &= 20 \\ 0 \times 2 &= 0 \end{aligned}$$

$$\begin{aligned} 5 \times -1 &= -5 \\ 0 \times -3 &= 0 \end{aligned}$$

$$\begin{aligned} -2 \times 4 &= -8 \\ 6 \times 2 &= 12 \end{aligned}$$

$$\begin{aligned} -2 \times -1 &= 2 \\ 6 \times -3 &= -18 \end{aligned}$$

$$BA = \begin{pmatrix} 20 & -5 \\ 4 & -16 \end{pmatrix} \quad \checkmark$$

$$BA \neq AB \quad \checkmark$$

5

d) Inverse of A

$$\begin{pmatrix} 4 & -1 \\ 2 & -3 \end{pmatrix}$$

$$\begin{pmatrix} -3 & 1 \\ -2 & 4 \end{pmatrix}$$

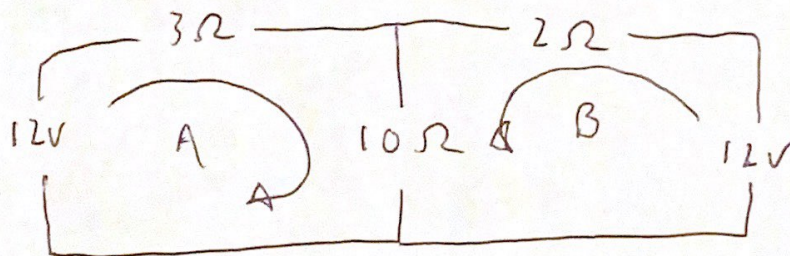
$$a \times d - c \times b = -10$$

$$-\frac{1}{10}$$

$$A^{-1} = \begin{pmatrix} \frac{3}{10} & -\frac{1}{10} \\ \frac{1}{5} & -\frac{2}{5} \end{pmatrix}$$

5

6.



$$A: 12V = 13I_1 + 10I_2$$

$$B: 12V = 10I_1 + 12I_2$$

$$\begin{bmatrix} 13 & 10 \\ 10 & 12 \end{bmatrix}$$

$$\begin{bmatrix} 13 & 10 \\ 10 & 12 \end{bmatrix}$$

$$\begin{bmatrix} 13 & 12 \\ 10 & 12 \end{bmatrix}$$

$$\begin{bmatrix} 13 & 10 \\ 10 & 12 \end{bmatrix}$$

12

$$\frac{a \times d - c \times b}{a \times d - c \times b} = \frac{3}{7} A$$

$$\frac{a \times d - c \times b}{a \times d - c \times b} = \frac{9}{14} A$$

$$7.a) (-2, 3) \quad (4, 5)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{1}{3} \quad \checkmark$$

$$y = mx + c$$

$$5 = \frac{1}{3} \times 4 + c \quad \checkmark$$

$$c = \frac{11}{3} \quad \checkmark$$

4

$$b) -\frac{1}{m} \quad (2, 3)$$

$$y = -3x + c \quad \checkmark$$

$$3 = -3 \times 2 + c \quad \checkmark$$

$$y = -3x + 9 \quad \checkmark$$

5

$$8. a + (n-1)d$$

$$1.5 + (50-1) \times 0.7 = £35.80 \quad \checkmark$$

4

$$9. \quad 5 \text{ speed} \quad 10 - 700$$

$$ar^{n-1}$$

$$10r^{5-1} = 700$$

$$r^{5-1} = 70 \quad \checkmark$$

$$r = \sqrt[5-1]{70} \quad \checkmark$$

$$1 = 10 \quad 3 = 83.69 \text{ rev/min} \quad \checkmark$$

$$2 = 28.93 \text{ rev/min} \quad 4 = 241.128 \text{ rev/min} \quad \checkmark$$

$$r = 2.893 \quad \checkmark$$

give to nearest rev/min (7)