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Mathematics resit 2021

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Q1 i) $A+B$

$$\begin{bmatrix} 3+1 & 1+2 & -2+3 \\ 1+2 & 2-2 & 1-2 \\ 0+1 & 1+2 & 2+3 \end{bmatrix} \approx \begin{bmatrix} 4 & 3 & 1 \\ 3 & 0 & -1 \\ 1 & 3 & 5 \end{bmatrix}$$

ii) $A-B$

$$\begin{bmatrix} 3-1 & 1-2 & -2-3 \\ 1-2 & 2-2 & 1-2 \\ 0-1 & 1-2 & 2-3 \end{bmatrix} \approx \begin{bmatrix} 2 & -1 & -5 \\ -1 & 4 & 3 \\ -1 & -1 & -1 \end{bmatrix}$$

iii) AB

$$\begin{bmatrix} 3 & 1 & -2 \\ 1 & 2 & 1 \\ 0 & 1 & 2 \end{bmatrix} \times \begin{bmatrix} 1 & 2 & 3 \\ 2 & -2 & -2 \\ 1 & 2 & 3 \end{bmatrix} = \begin{bmatrix} 3 & 0 & 1 \\ 6 & 0 & 2 \\ 4 & 2 & 4 \end{bmatrix}$$

$$(3 \times 1) + (1 \times 2) + (-2 \times 1) = 3 \quad (1 \times 1) + (2 \times 2) + (1 \times 1) = 6$$

$$(1 \times 2) + (2 \times 2) + (1 \times -2) = 0 \quad (1 \times 2) + (2 \times -2) + (1 \times -2) = 0$$

$$(3 \times 2) + (1 \times -2) + (-2 \times 2) = 0 \quad (1 \times 3) + (2 \times -2) + (1 \times 3) = 2$$

$$(3 \times 3) + (1 \times -2) + (-2 \times 3) = 1 \quad (0 \times 1) + (1 \times 2) + (2 \times 1) = 4$$

$$(0 \times 2) + (1 \times -2) + (2 \times 2) = 2$$

$$(0 \times 3) + (1 \times -2) + (2 \times 3) = 4$$

iv) B^T

$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & -2 & 2 \\ 3 & -2 & 3 \end{bmatrix}$$

Q2) $|A| = a(ei - fh) - b(di - fg) + c(dh - eg)$

$$\begin{bmatrix} a & b & c \\ d & e & f \\ g & h & i \end{bmatrix}$$

$$A = \begin{bmatrix} 2 & -4 & 8 \\ 4 & 6 & 2 \\ 2 & 12 & -4 \end{bmatrix}$$

$$|A| = 2 \times \begin{bmatrix} 6 & 2 \\ 12 & -4 \end{bmatrix} - (-4) \times \begin{bmatrix} 4 & 2 \\ 2 & -4 \end{bmatrix} + 8 \times \begin{bmatrix} 4 & 6 \\ 2 & 12 \end{bmatrix}$$

$$= 2(-24 - 24) - (-4)(-16 - 4) + 8(48 - 12)$$

$$= -96 - 80 + 288$$

$$|A| = 112$$

Q3) $x - 2y + 3z = 8$ (a) $x = 8 + 2y - 3z$

$x + y - 2z = 4$ (b) $x = 4 - y + 2z$

$2x + y + z = 6$ (c) $2x = 6 - y - z$

$8 + 2y - 3z = 8 + 2y - 3z$ (a)

$8 + 2y - 3z = 4 - y + 2z$ (b) $4 + 3y - 5z = 0$ $4 + 3(-2 + z) - 5z$

$16 + 4y - 6z = 6 - y - z$ (c) $10 + 5y - 5z = 0$ (c)

$y = -2 + z$

$x = 8 + (-4 + 2z) - 3z$ (a) $x = 4 - z$ (a) $x = 4 - 1 = 3$

$4 = 2 - 2z$ (b) $z = -1$ (b)

$y = -2 + z$ (c) $y = -2 + 1 = -1$ (c) $y = -2 - 1 = -3$

$\therefore x = 3, y = -3, z = -1$

$$\text{Q4 i)} \quad \frac{4a^3 - 6a^2 - 12a}{2a} = \frac{2a(2a^2 - 3a - 6)}{2a} \\ = 2a^2 - 3a - 6$$

$$\text{ii)} \quad (6x^2 + 19x + 13) \div (2x + 5)$$

$$\begin{array}{r} x \quad 3x + 2 \\ 2x + 5 \overline{) 6x^2 + 19x + 13} \\ \underline{-6x^2 - 15x} \\ 4x + 13 \\ \underline{-4x - 10} \\ +3 \end{array}$$

$$= 3x + 2 + \frac{3}{2x+5}$$

$$\text{Q5} \quad \frac{x+2}{(1+x)(2-x)}$$

$$\text{Q6} \quad \begin{array}{ccc} a & b & c \\ 2x^2 - x - 15 = 0 & x = \frac{+1 \pm \sqrt{1^2 - 4 \times 2 \times -15}}{4} \end{array}$$

$$2(s)^2 - 3 - 15 = 0 \quad \checkmark$$

$$2(2.5)^2 - 2.5 - 15 = 0 \quad \checkmark$$

$$x = 3 \text{ or } -2.5$$

$$\text{Q7 i)} \quad 5 + 7(x+1) = 7x + 12$$

$$5 + 7x + 7 = 7x + 12$$

$$7x + 12 = 7x + 12$$

$$x = -\infty, \infty \quad / \quad x = 0, 0$$

$$\text{ii)} \quad (15x - 10) \times 2 = (8 + 3x)5 \quad \approx 30x - 20 = 40 + 15x \\ 15x = 60 \\ x = 4$$

Q8i) $S = ut + 0.5at^2$
 $S - ut = 0.5at^2$

$$\frac{S}{0.5t^2} - \frac{ut}{0.5t^2} = a$$

$$a = \frac{2S}{t^2} - \frac{2u}{t} = a = \frac{2S}{t^2} - \frac{2u}{t}$$

(check SUVAT equations)

ii) $\frac{1}{r} = \frac{2}{a} + \frac{6}{s}$

$$\frac{1}{r} - \frac{6}{s} = \frac{2}{a}$$

$$\frac{1}{r}(ars) - \frac{6}{s}(ars) = \frac{2}{a}(ars)$$

$$as - 6ar = 2rs$$

$$as = 2rs + 6ar \quad a(s - 6r) = 2rs$$

$$a = \frac{2rs + 6ar}{s} \quad a = \frac{2rs}{s - 6r}$$

$$= a = \frac{2rs}{s - 6r}$$