

STUDENT NAME: CATALINA TRASC

STUDENT ID NUMBER: 2018162

MODULE: APPLIED ANALYTICS

1. a) $W = 1 + \frac{1}{V}$

$$W - 1 = \frac{1}{V} \Rightarrow V = \frac{1}{W-1}$$

When $W = 0.5 \Rightarrow \frac{1}{V} = \frac{1}{0.5-1} \Rightarrow V = \frac{1}{-0.5} \Rightarrow \underline{\underline{V = -2}}$

b) (i) $3x + 5 = 7x - 7$

$$3x - 7x = -7 - 5 \Rightarrow -4x = -12 \Rightarrow 4x = 12 \Rightarrow x = \frac{12}{4} \Rightarrow \underline{\underline{x = 3}}$$

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

$$4(x+3) = 2(x-3) \Rightarrow 4x + 12 = 2x - 6 \Rightarrow 4x - 2x = -6 - 12$$

$$\Rightarrow 2x = -18 \Rightarrow \underline{\underline{x = -9}}$$

(iii) $\frac{1}{x-1} = \frac{5}{2}$

$$1 \cdot 2 = 5(x-1) \Rightarrow 2 = 5x - 5 \Rightarrow 2 + 5 = 5x \Rightarrow 7 = 5x$$

$$\Rightarrow x = \frac{7}{5} \Rightarrow \underline{\underline{x = 1.4}}$$

c) (i) $2x^2 + 12x + 15 = 0$

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

Where $a = 2$; $b = 12$; $c = 15$

$$\Rightarrow x = \frac{-12 \pm \sqrt{12^2 - 4 \cdot 2 \cdot 15}}{2 \cdot 2} \Rightarrow x = \frac{-12 \pm \sqrt{144 - 120}}{4}$$

$$\Rightarrow x = \frac{-12 \pm \sqrt{124}}{4} \Rightarrow x = \frac{-12 \pm \sqrt{4 \cdot 6}}{4} \Rightarrow$$

$$x = \frac{-6 \pm \sqrt{6}}{2} \Rightarrow x = \frac{-6 \pm 2.45}{2} \Rightarrow x = \frac{-6 - 2.45}{2} \text{ or } x = \frac{-6 + 2.45}{2}$$
$$\Rightarrow \underline{\underline{x = -4.23}} \text{ or } \underline{\underline{x = -2.23}}$$

(ii) $x^2 - 16 = 6x$

$$x^2 - 6x - 16 = 0$$

$$(x-8)(x+2) = 0 \Rightarrow \underline{\underline{x = 8}} \text{ or } \underline{\underline{x = -2}}$$
$$x^2 + 2x - 8x - 16 = 0 \Rightarrow x^2 - 6x - 16 = 0$$

(iii) $x^2 = 12 - x$

$$x^2 + x - 12 = 0$$

$$\Rightarrow (x+4)(x-3) = 0 \Rightarrow \underline{\underline{x = -4}} \text{ or } \underline{\underline{x = 3}}$$

$$x^2 - 3x + 4x - 12 = 0 \Rightarrow x^2 + x - 12 = 0$$

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d) (i) $3x^2 + 13x = -4$

$$3x^2 + 13x + 4 = 0$$

$$(3x+1)(x+4) = 0 \Rightarrow 3x = -1 \Rightarrow x = -\frac{1}{3} \Rightarrow \underline{\underline{x = -0,33}}$$

m) $\underline{\underline{x = -4}}$

(ii) $x^2 - y^2 = (x+y)(x-y)$

(iii) $ay - bx + by - ax$

$$ay - ax - bx + by \rightarrow a(y-x) + b(y-x) \rightarrow \underline{\underline{(a+b)(y-x)}}$$

e) (i) $2x + 5y = 39 \quad | \cdot (-2)$

$$4x + y = 33$$

$$\Rightarrow -4x - 10y = -78$$

$$4x + y = 33 \quad (+)$$

$$1 - 9y = -45 \Rightarrow 9y = 45 \Rightarrow y = \frac{45}{9} \Rightarrow \underline{\underline{y = 5}}$$

$$2x + 5y = 39 \rightarrow 2x + 5 \cdot 5 = 39 \rightarrow 2x + 25 = 39$$

$$\rightarrow 2x = 39 - 25 \rightarrow 2x = 14 \rightarrow \underline{\underline{x = 7}}$$

(ii) $y = 3x - y = -5 \quad | \cdot 3$

$$-4x + 3y = 15$$

$$\rightarrow 9x - 3y = -15$$

$$-4x + 3y = 15 \quad (+)$$

$$2x / = 0 \rightarrow \underline{\underline{x = 0}}$$

$$\rightarrow -4 \cdot 0 + 3y = 15 \Rightarrow 3y = 15 \Rightarrow y = \frac{15}{3} \Rightarrow \underline{\underline{y = 5}}$$

(iii) $x^2 - 7x + 3 = 0$

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

Where $a = 1$; $b = -7$; $c = 3$

$$\Rightarrow x = \frac{7 \pm \sqrt{(-7)^2 - 4 \cdot 1 \cdot 3}}{2 \cdot 1} \Rightarrow x = \frac{7 \pm \sqrt{49 - 12}}{2} \Rightarrow x = \frac{7 \pm \sqrt{37}}{2}$$

$$\Rightarrow x = \frac{7}{2} \pm \frac{1}{2} \sqrt{37} \Rightarrow x = \frac{7}{2} \pm \frac{\sqrt{37}}{2} \Rightarrow x = \frac{7}{2} + \frac{\sqrt{37}}{2}$$

$$\Rightarrow x = 3.5 + \frac{6.08}{2} \Rightarrow x = 3.5 + 3.04 \Rightarrow \underline{\underline{x = 6.54}} \quad \text{or}$$

$$x = \frac{7}{2} - \frac{\sqrt{37}}{2} \Rightarrow x = 3.5 - \frac{6.08}{2} \Rightarrow x = 3.5 - 3.04 \Rightarrow \underline{\underline{x = 0.46}}$$

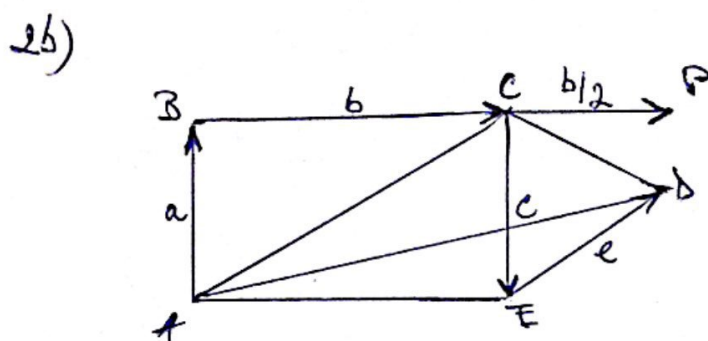
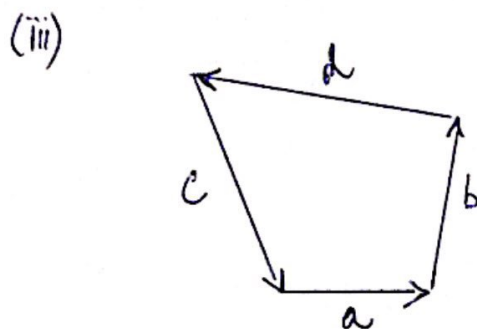
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2a)

(i) $\vec{a} = 10$

(ii) $\vec{a} = 10 \Rightarrow \vec{a} = -10$

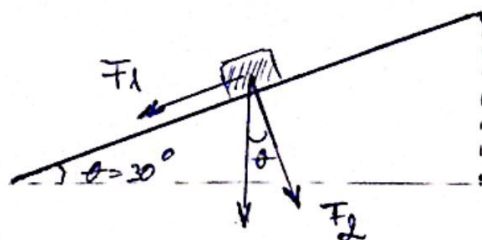


(i) $\vec{AD} = a + b + c + e$

(ii) $\vec{EB} = -c - b$

(iii) $\vec{AP} = a + b + \frac{b}{2}$

2c)



$W = 220 \text{ N}$

$\sin 30^\circ = \frac{1}{2}$

$\cos 30^\circ = \frac{\sqrt{3}}{2}$

$m = \frac{G}{g} = \frac{220 \text{ N}}{9.8} = 22.45 \text{ kg}$

(i) $F_1 = m \cdot g \cdot \sin 30^\circ$

$F_2 = m \cdot g \cdot \cos 30^\circ$

(ii) $F_1 = mg \cdot \sin 30^\circ$

$F_1 = 22.45 \cdot 9.8 \cdot \frac{1}{2} = 110 \text{ N} \Rightarrow \underline{F_1 = 110 \text{ N}}$

$F_2 = m \cdot g \cdot \cos 30^\circ \Rightarrow \underline{F_2 = 22.45 \cdot 9.8 \cdot \frac{\sqrt{3}}{2} = 190.31 \text{ N}}$

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3a) (i) $V = i \cdot R$

$i = 0,2 \text{ mA} ; R = 0,25 \Omega$

$\Rightarrow V = 0,2 \text{ mA} \cdot 0,25 \Omega$

$V = 5 \text{ V} \cdot 10^{-5}$

(iv) $T = \frac{Q}{i}$

$Q = 1,1 \text{ mC} ; i = 0,2 \text{ mA}$

$\rightarrow T = \frac{1,1 \text{ mC}}{0,2 \text{ mA}}$

$\rightarrow \underline{\underline{T = 5,5 \Delta}}$

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3b) (i) $R_1 = 0.82 \Omega$; $R_2 = 1.95 \Omega$; $R_3 = 10.5 \Omega$
 $R_4 = 1.5 \Omega$; $V_T = 24 V$

$$\frac{1}{R_{1,2,3}} = \frac{1}{0.82 \Omega} + \frac{1}{1.35 \Omega} + \frac{1}{10.5 \Omega}$$

$$\frac{1}{R_{1,2,3}} = 1.22 \Omega + 0.74 \Omega + 0.095 \Omega$$

$$\frac{1}{R_{1,2,3}} = 2.06 \Omega$$

$$\Rightarrow R_{1,2,3} = \frac{1}{2.06 \Omega} \Rightarrow R_{1,2,3} = 0.49 \Omega$$

$$R_T = R_{1,2,3} + R_4 \Rightarrow R_T = 0.49 \Omega + 1.5 \Omega$$
$$\Rightarrow \underline{R_T = 1.99 \Omega}$$

(ii) $V_T = I_T \cdot R_T$
 $\Rightarrow I_T = \frac{V_T}{R_T} \Rightarrow I_T = \frac{24 V}{1.99 \Omega} \Rightarrow \underline{I_T = 12.06 A}$

(iii) $V_4 = I_4 \cdot R_4$
 $V_4 = 12.06 A \times 1.5 \Omega \Rightarrow \underline{V_4 = 18.09 V}$

(iv) $V_T - V_4 \Rightarrow$
 $24 V - 18.09 V = \underline{5.91 V}$ is the potential diff
 $\Rightarrow V = I \cdot R \rightarrow V = 5.91 V \times 1.35 \Omega$
 $\Rightarrow \underline{V = 7.98 A}$

(v) $V_1 = I_1 \cdot R_1$
 $V_1 = 5.91 V \times 0.82 \Omega \rightarrow V_1 = 4.84 A$
 $V_2 = 5.91 V \times 1.35 \Omega \rightarrow V_2 = 7.98 A$
 $V_3 = 5.91 V \times 10.5 \Omega \rightarrow \underline{V_3 = 62.06 A}$

$\Rightarrow$ The resistor which transfers the most energy
is R_3 .