G.C.E A/L Examination November - 2018

Fied Work Centre

FWC

Grade - 12 (2020) **Cpmbined Mathematics** **Marking Scheme**

1]

$$\sqrt{\frac{x^2-36}{x}} + 12\sqrt{\frac{x}{x^2-36}} = 7$$

let $\sqrt{\frac{x^2-36}{x}} = t$

$t + \frac{12}{t} = 7$ (5)

$t^2 - 7t + 12 = 0$

$(t-3)(t-4) = 0$ (5)

$t = 3$ or $t = 4$ (5)

$t = 3$

$\sqrt{\frac{x^2-36}{x}} = 3$

$x^2 - 9x - 36 = 0$

$(x-12)(x+3) = 0$

$x = 12$ or $x = -3$ (5)

$t = 4$ $\sqrt{\frac{x^2-36}{x}} = 4 \Rightarrow x^2 - 16x - 36 = 0$

$(x-18)(x+2) = 0$

(5) $x = 18$ or $x = -2$

$\boxed{25}$

2]

$\frac{2x}{x-2} \leq 1$

$\frac{2x}{x-2} - 1 \leq 0$ (5)

$\frac{x+2}{x-2} \leq 0$ (5) ; $x \neq 2$

	$-\infty < x < -2$	$-2 \leq x < 2$	$2 < x < \infty$
$(x-2)$	$(-)$	$(-)$	$(+)$
$(x+2)$	$(-)$	$(+)$	$(+)$ (10)
$\frac{(x+2)}{(x-2)}$	$(+)$	$(-)$	$(+)$

$\therefore$ Solutions $-2 \leq x < 2$ (5)

$\boxed{25}$

3]

$\frac{\log x}{3} = \frac{\log y}{4} = \frac{\log z}{35} = t$

$\log x = 3t$, $\log y = 4t$, $\log z = 35t$ (5)

$\log x^5y^5 = 5 \log xy$ (5)

$= 5(\log x + \log y)$ (5)

$= 5.(3t + 4t)$

$= 35t = \log z$ (5)

$x^5y^5 = z$ (5)

$\boxed{25}$

4]

$f(x) < 0 \quad \forall x \in \mathbb{R}$

then $\Delta < 0$ (5)

$(b+2)^2 - 4.(b-1).(-1) < 0$ (5)

$b^2 + 4b + 4 + 4b - 4 < 0$

$b^2 + 8b < 0$ (5)

$b(b+8) < 0$ (5)

$(+)$ -8 $(-)$ 0 $(+)$

$\therefore$ Solutions are $-8 < b < 0$ (5)

$\boxed{25}$

5]

$\tan 2A = \tan((A+B) + (A-B))$ (5)

$= \frac{\tan(A+B) + \tan(A-B)}{1 - \tan(A+B)\tan(A-B)}$ (10)

$= \frac{\frac{1}{3} + \frac{1}{4}}{1 - \frac{1}{3} \times \frac{1}{4}}$ (5)

$= \frac{7}{12} / \frac{11}{12}$

$= 7/11$ (5)

$\boxed{25}$

6]

$\cos\alpha = \frac{4}{5}$ $\quad \sin^2\alpha = 1 - \cos^2\alpha$

$= 1 - \frac{16}{25} = \frac{9}{25}$

$\sin\alpha = 3/5$ $\quad 0 < \alpha < \pi/2$ (5)

$\sin\beta = \frac{5}{13}$ $\quad \cos^2\beta = 1 - \sin^2\beta = 1 - \frac{25}{169} = \frac{144}{169}$

$\cos\beta = -\frac{12}{13}$ (5) $\quad \pi/2 < \beta < \pi$

$\cos(\alpha+\beta) = \cos\alpha\cos\beta - \sin\alpha\sin\beta$ (5)

$= \frac{4}{5} \times \left(-\frac{12}{13}\right) - \left(\frac{3}{5}\right)\left(\frac{5}{13}\right)$ (5)

$= -\frac{63}{65}$ (5)

$\boxed{25}$

$\vec{AB} = (2\underline{a} - \underline{b}) - \underline{a}$
$\quad = \underline{a} - \underline{b}$ 5

$\vec{AC} = \underline{b} - \underline{a}$ 5

$\vec{CA} = \underline{a} - \underline{b}$ 5

$\therefore \vec{AB} = \vec{CA}$ 5

$\Rightarrow AB \parallel CA$

$\Rightarrow A, B, C$ Collinear 5

(8) $\underline{a} = 2\sqrt{3}\underline{i} + 2\underline{j}$, $\underline{b} = -3\sqrt{3}\underline{i} + 3\underline{j}$

$\underline{a}\cdot\underline{b} = (2\sqrt{3}\underline{i} + 2\underline{j})\cdot(-3\sqrt{3}\underline{i} + 3\underline{j})$ 5

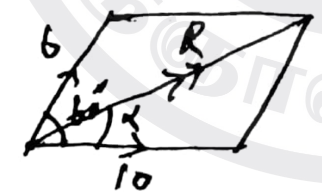
$|\underline{a}||\underline{b}| \cos\theta = -18 + 6$ 10

$4 \cdot 6 \cos\theta = -12$

$\cos\theta = -\frac{1}{2}$ 5

$\theta = 2\pi/3$ 5

(9)



$R^2 = 10^2 + 6^2 + 2.6.10.\cos 60$ 10

$= 100 + 36 + 60$

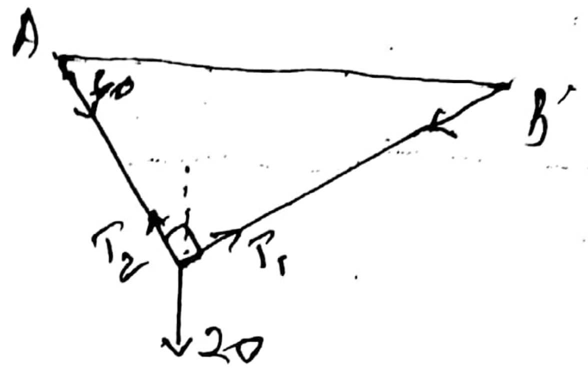
$= 196$

$R = 14$ 5

$\tan\alpha = \frac{6\sin 60}{10 + 6\cos 60}$ 5

$= \frac{3\sqrt{3}}{13}$

$\alpha = \tan^{-1}\left(\frac{3\sqrt{3}}{13}\right)$ 5



$\frac{T_1}{\sin 150} = \frac{T_2}{\sin 120} = \frac{20}{\sin 90}$ 10

$\frac{T_1}{\frac{1}{2}} = \frac{T_2}{\frac{\sqrt{3}}{2}} = 20$ 5

$T_1 = 10$, 5

$T_2 = 10\sqrt{3}$ 5

Q11] a] ∵ $a = x + \frac{1}{x}$

$a^2 = (x + 1/x)^2 = x^2 + 2 + 1/x^2$ (5)

$\Rightarrow x^2 + 1/x^2 = a^2 - 2$ (5)

$x^3 + \frac{1}{x^3} = \left(x + \frac{1}{x}\right)^3 - 3(x + 1/x)$ (5)

$= a^3 - 3a$ (5)

$\left(x^5 + \frac{1}{x^5}\right) = \left(x^3 + \frac{1}{x^3}\right)\left(x^2 + \frac{1}{x^2}\right) - (x + 1/x)$

$= (a^3 - 3a)(a^2 - 2) - a$ (5) (10)

$= a^5 - 5a^3 + 6a - a = a(a^4 - 5a^2 + 5)$ (5) $\boxed{40}$

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b] $\frac{y+z-x}{4} = \frac{z+x-y}{5} = \frac{x+y-z}{6} = t$ (say)

$y + z - x = 4t$ — ①
$z + x - y = 5t$ — ② (5)
$x + y - z = 6t$ — ③

$\Rightarrow x + y + z = 15t$ → ④ (5)

④-① $2x = 11t$
④-② $2y = 10t$ (10) $\Rightarrow \frac{2x}{11} = \frac{2y}{10} = \frac{2z}{9}$ (5)
④-③ $2z = 9t$

$\frac{x}{11} = \frac{y}{10} = \frac{z}{9}$ (5) $\boxed{30}$

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c] let $\log_a b = x$ $\log_b a = y$ (5)

$\Rightarrow b = a^x$ ① $\Rightarrow a = b^y$ ②

①,② $\Rightarrow a = (a^x)^y = a^{xy}$

$\log_a a = xy = 1$ (5)

$\log_a b \cdot \log_b a = 1 \Rightarrow \log_a b = \frac{1}{\log_b a}$ (5) $\boxed{15}$

$\log_5 x^2 + \log_{5x}\left(\frac{5}{x}\right) = 1$

$2\log_5 x + \log_{5x} 5 - \log_{5x} x = 1$ (5)

$2\log_5 x + \frac{1}{\log_5 x + 1} - \frac{1}{\log_x 5 + 1} = 1$ (10)

let $t = \log_5 x$

$2t + \frac{1}{t+1} - \frac{t}{1+t} = 1$ (5)

$2t(t+1) + 1 - t = t + 1$ (5)

$2t^2 = 0$
$t = 0$ (5)

$\log_5 x = 0 \Rightarrow x = 1$ (5)

$\boxed{35}$

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d] $\sqrt{5x-9} + 1 = x$ — (*)

$5x - 9 = (x-1)^2 = x^2 - 2x + 1$ (5)

$x^2 - 7x + 10 = 0$ (10)

$(x-5)(x-2) = 0$ (5)

$x = 5$ or $x = 2$

If $x = 5$
L.H.S $= \sqrt{25-9} + 1 = 5 =$ R.H.S
$x = 5$ is a Solution Of (*)

If $x = 2$
L.H.S $= \sqrt{10-9} + 1 = 2 =$ R.H.S
$x = 2$ is also Solution of (*)

Q12] a) $ax^2 + bx + c = 0$

$\Delta = b^2 - 4ac$ (10)

If Roots are real then $\Delta \geq 0$

$b^2 - 4ac \geq 0$ (5)

$b^2 \geq 4ac$ (5)

$\left(\frac{b}{2}\right)^2 \geq ac$

$\boxed{20}$

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b) $ax^2 + (a+b)x + b = 0$

$\Delta = (a+b)^2 - 4ab$ (10)

$= a^2 + 2ab + b^2 - 4ab$

$= a^2 - 2ab + b^2$ (5)

$= (a-b)^2 \geq 0$ (5) $\boxed{20}$

So roots are real.

Let α, β be the roots of $ax^2 + (a+b)x + b = 0$

$\alpha + \beta = -\frac{(a+b)}{a}$ — (10)

$\alpha\beta = \frac{b}{a}$ — (10)

$\boxed{20}$

$\frac{(\alpha+1)}{\beta}+\frac{(\beta+1)}{\alpha}$

$=\frac{\alpha^2+\alpha+\beta^2+\beta}{\alpha\beta}$ 10

$=\frac{(\alpha+\beta)^2+(\alpha+\beta)-2\alpha\beta}{\alpha\beta}$

$=\frac{\frac{(a+b)^2}{a^2}-\frac{(a+b)}{a}-\frac{2b}{a}}{\frac{b}{a}}$ 10

$=\frac{a^2+2ab+b^2-a^2-ab-2ab}{ab}$ 5

$=\frac{b(b-a)}{ab}=\frac{(b-a)}{a}$ — 1 5

$\boxed{30}$

$\frac{(\alpha+1)}{\beta}\frac{(\beta+1)}{\alpha}=\frac{\alpha\beta+(\alpha+\beta)+1}{\alpha\beta}$ 10

$=\frac{\frac{b}{a}-\frac{(a+b)}{a}+1}{b/a}$ 10

$=\frac{\frac{b}{a}-1-\frac{b}{a}+1}{b/a}=0$ — 2 5

The quadratic equation with $\frac{(\alpha+1)}{\beta}$ and $\frac{(\beta+1)}{\alpha}$ as its roots is

$x^2-\left(\frac{\alpha+1}{\beta}+\frac{\beta+1}{\alpha}\right)x+\left[\frac{(\alpha+1)}{\beta}+\frac{(\beta+1)}{\alpha}\right]=0$

$x^2-\left(\frac{b-a}{a}\right)x=0$ — 10

$ax^2+(a-b)x=0$ 5

$\boxed{40}$

If $\alpha=\beta$

2 $\frac{(\alpha+1)^2}{\alpha^2}=0$ 5 $\Rightarrow\left(\frac{\alpha+1}{\alpha}\right)=0$

1 $\Rightarrow\ \frac{2(\alpha+1)}{\alpha}=\frac{b-a}{a}=0$ 10

$\Rightarrow a=b$ 5

$\boxed{20}$

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

$=Ax+B+\frac{C}{(x+1)}+\frac{D}{(x-1)}$ — 10

$2x^3+x^2-2x+1=(Ax+B)(x^2-1)+C(x-1)+D(x+1)$

$x=1$ $f(2)=2=2D\Rightarrow D=1$ 5

$x=-1$ $f(-2)=2=-2C\Rightarrow C=-1$ 5

$x^3\Rightarrow A=2$ 5

$x^2\Rightarrow B=1$ 5

$\frac{f(x)}{(x-1)(x+1)}=2x+1-\frac{1}{x+1}+\frac{1}{x-1}$

$\boxed{30}$

$\frac{f(x)}{(x^2-1)}=(2x+1)+\frac{-x+1+x+1}{(x^2-1)}$ 5

$\frac{f(x)}{(x^2-1)}=(2x+1)+\frac{2}{(x^2-1)}$ 5

When $f(x)$ is divided by $(x^2-1)\Rightarrow 2$ the remainder 5 quotient $(2x+1)$ 5

$\boxed{20}$

b] $f(x)=x^4+ax^3-2x^2+bx+c$

$(x+1)$ is a factor of $f(x)$

So $f(x)=\phi(x).(x+1)$ 10

$f(-1)=-a-1-b+c=0$

$a+b-c=-1$ — 1 10

$-7x-11$ is remainder when $f(x)$ is divided by (x^2+2x-3)

$f(x)=\psi(x)(x+3)(x-1)-7x-11$ 15

$x=1$ $f(1)=a+b+c=-17$ — 2 10

$x=-3$ $f(-3)=81-27a-18-3b+c=21-11$

$27a+3b-c=63$ — 3 10

1, 2, 3 $\quad c=-8$ 5

$b=-12$ 5

$a=3$ 5

$f(x)=x^4+3x^3-2x^2-12x-8$

$\boxed{70}$

$\tan 3A$

$= \tan(2A+A)$ 5

$= \dfrac{\tan 2A + \tan A}{1 - \tan 2A \tan A}$ 5

$= \dfrac{\dfrac{2\tan A}{1-\tan^2 A} + \tan A}{1 - \dfrac{2\tan A}{1-\tan^2 A}\tan A}$ 5

$= \dfrac{2\tan A + \tan A - \tan^3 A}{1 - \tan^2 A - 2\tan^2 A}$ 5

$= \dfrac{3\tan A - \tan^3 A}{1 - 3\tan^2 A}$ 5

$\boxed{25}$

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put $A = \frac{\pi}{8}$ 5

$\tan\frac{\pi}{4} = \dfrac{2\tan\frac{\pi}{8}}{1-\tan^2\frac{\pi}{8}}$ 5

$1 - \tan^2\frac{\pi}{8} = 2\tan\frac{\pi}{8}$ 5

$\tan^2\frac{\pi}{8} + 2\tan\frac{\pi}{8} - 1 = 0$ $\boxed{15}$

put $A = \frac{\pi}{12}$ 5

$\tan\frac{\pi}{4} = \dfrac{3\tan\frac{\pi}{12} - \tan^3\frac{\pi}{12}}{1 - 3\tan^2\frac{\pi}{12}}$ 5

$1 - 3\tan^2\frac{\pi}{12} = 3\tan\frac{\pi}{12} - \tan^3\frac{\pi}{12}$ 5

$\tan^3\frac{\pi}{12} - 3\tan^2\frac{\pi}{12} - 3\tan\frac{\pi}{12} + 1 = 0$ $\boxed{15}$

(b)

$x = \sec\theta - \tan\theta$

$= \dfrac{1-\sin\theta}{\cos\theta}$ 5

$y = \operatorname{cosec}\theta + \cot\theta$

$= \dfrac{1+\cos\theta}{\sin\theta}$ 5

$xy + x - y + 1$

$= \left(\dfrac{1-\sin\theta}{\cos\theta}\right)\left(\dfrac{1+\cos\theta}{\sin\theta}\right) + \dfrac{1-\sin\theta}{\cos\theta} - \dfrac{1+\cos\theta}{\sin\theta} + 1$ 10

$= \dfrac{1 + \cancel{\cos\theta} - \cancel{\sin\theta} - \cancel{\sin\theta\cos\theta} + \cancel{\sin\theta} - \sin^2\theta - \cancel{\cos\theta} - \cos^2\theta + \cancel{\sin\theta\cos\theta}}{\sin\theta\cos\theta}$ 15

$\boxed{40}$

$= \dfrac{1-1}{\sin\theta\cos\theta} = 0$ 5

(c) $\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ$

$= \frac{1}{2}\{\cos 20^\circ \cos 40^\circ \cos 80^\circ\}$ 5

$= \frac{1}{4}\{\cos 60^\circ + \cos 20^\circ\}\cos 80^\circ$ 5

$= \frac{1}{4}[\cos 60^\circ \cos 80^\circ + \cos 80^\circ \cos 20^\circ]$ 5

$= \frac{1}{4}[\frac{1}{2}\cos 80^\circ + \cos 80^\circ \cos 20^\circ]$ 5

$= \frac{1}{8}[\cos 80^\circ + 2\cos 80^\circ \cos 20^\circ]$

$= \frac{1}{8}[\cos 80^\circ + \cos 100^\circ + \cos 60^\circ]$ 5

$= \frac{1}{8}[\cos 80^\circ + \cos 100^\circ + \cos 60^\circ]$ 5

$= \frac{1}{8}[\cos 80^\circ - \cos 80^\circ + \cos 60^\circ]$ 5

$= \frac{1}{16}$ 5 $\boxed{35}$

Aliter

$\cos 20^\circ \cos 40^\circ \cos 60^\circ \cos 80^\circ$

$= \frac{1}{2}\cos 20^\circ \cos 40^\circ \cos 80^\circ$ 5

$= \dfrac{1}{4\sin 20^\circ}\sin 40^\circ \cos 40^\circ \cos 80^\circ$ 10

$= \dfrac{1}{8\sin 20^\circ}\sin 80^\circ \cos 80^\circ$ 5

$= \dfrac{1}{16\sin 20^\circ}\sin 160^\circ$ 5

$= \dfrac{\sin 20^\circ}{16\sin 20^\circ}$ 5

$= \dfrac{1}{16}$ 5 $\boxed{35}$

$f(x) = (x+p)(x+1)(x+q)$

$\quad = (x^2+2px+p^2)(x^2+(q+1)x+q)$

$x^3 \Rightarrow 2p+q+1 = 3$ 5

$\quad 2p+q = 2 \quad$ — ①

$x^2 \Rightarrow 2p(q+1)+p^2+q = -2$ — ② 5

①,② $2p(3-2p)+p^2+2-2p = -2$ 5

$3p^2-4p-4 = 0$

$(3p+2)(p-2) = 0$ 5

$p = 2$ or $p = -2/3$ 5

then $q = -2$ or then $q = 10/3$ 5 $\boxed{30}$

14 (a) (i)

$$\frac{1}{1-\cos\theta} + \frac{1}{1+\cos\theta}$$

$$= \frac{(1+\cos\theta)+(1-\cos\theta)}{(1-\cos\theta)(1+\cos\theta)} \quad 5$$

$$= \frac{2}{1-\cos^2\theta} \quad 5$$

$$= \frac{2}{\sin^2\theta} \quad 5$$

$$= 2\operatorname{cosec}^2\theta \quad 5 \quad \boxed{20}$$

(ii) $$\frac{\cos\theta}{1+\sin\theta}$$

$$= \frac{\cos^2\theta/2 - \sin^2\theta/2}{\sin^2\theta/2+\cos^2\theta/2+2\sin\theta/2\cos\theta/2} \quad 15$$

$$= \frac{(\cos\theta/2-\sin\theta/2)(\cos\theta/2+\sin\theta/2)}{(\cos\theta/2+\sin\theta/2)^2} \quad 10$$

$$= \frac{\cos\theta/2-\sin\theta/2}{\cos\theta/2+\sin\theta/2} \quad 5$$

$$= \frac{1-\tan\theta/2}{1+\tan\theta/2} \quad 5$$

$$= \frac{\tan\frac{\pi}{4}-\tan\theta/2}{1+\tan\frac{\pi}{4}\tan\theta/2} \quad 5$$

$$= \tan\left(\frac{\pi}{4}-\frac{\theta}{2}\right) \quad 5 \quad \boxed{45}$$

$1+\sin 2\theta - \cos 2\theta$

$$= \frac{1+2\sin\theta\cos\theta+2\cos^2\theta-1}{1+2\sin\theta\cos\theta-(1-2\sin^2\theta)} \quad 15$$

$$= \frac{2\cos\theta(\sin\theta+\cos\theta)}{2\sin\theta(\cos\theta+\sin\theta)} \quad 5$$

$$= \cot\theta \quad \boxed{20}$$

(iv) $$\frac{\sin^2\theta}{1-\cos\theta} - \frac{\cos^2\theta}{1+\sin\theta}$$

$$= \frac{1-\cos^2\theta}{1-\cos\theta} - \frac{1-\sin^2\theta}{1+\sin\theta} \quad 10$$

$$= \frac{(1-\cos\theta)(1+\cos\theta)}{1-\cos\theta} - \frac{(1-\sin\theta)(1+\sin\theta)}{1+\sin\theta} \quad 5$$

$$= 1+\cos\theta-(1-\sin\theta) \quad 5$$

$$= \cos\theta+\sin\theta \quad 5 \quad \boxed{25}$$

(b) $\theta = 18^\circ$

$5\theta = 90^\circ$

$2\theta = 90^\circ - 3\theta$ 5

$\sin 2\theta = \sin(90^\circ-3\theta)$ 5

$\sin 2\theta = \cos 3\theta$ 5

$2\sin\theta\cos\theta = 4\cos^3\theta - 3\cos\theta$ 10

$2\sin\theta = 4\cos^2\theta - 3 \quad [\because \cos 18^\circ \neq 0]$

$\Rightarrow 2\sin\theta = 4(1-\sin^2\theta)-3$

$\Rightarrow 4\sin^2\theta + 2\sin\theta - 1 = 0$ 5

$$\Rightarrow \sin\theta = \frac{-2 \pm \sqrt{4-4(4)(-1)}}{2(4)}$$

$$= \frac{-2 \pm 2\sqrt{5}}{2(4)}$$

$$= \frac{-1 \pm \sqrt{5}}{4} \quad 5$$

$\sin 18^\circ > 0$ 5

$$\therefore \sin 18^\circ = \frac{\sqrt{5}-1}{4} \quad \boxed{40}$$

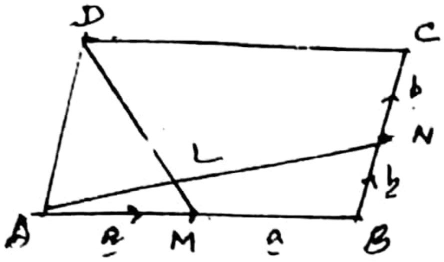
15. (a) $$\tan(A+B) = \frac{\tan A + \tan B}{1-\tan A\tan B} \quad 10 \quad \boxed{10}$$

Put $B = A$

$$\tan 2A = \frac{\tan A + \tan A}{1-\tan A\tan A} \quad 5$$

$$= \frac{2\tan A}{1-\tan^2 A} \quad 5 \quad \boxed{10}$$

16 a) $\alpha a + \beta b = 0 \Rightarrow \alpha = 0, \beta = 0$



(10)

$\vec{AN} = 2\underline{a} + \underline{b}$ (10)

$\vec{MD} = 2\underline{b} - \underline{a}$ (10)

$\vec{AL} = \lambda \vec{AN}$

$= \lambda(2\underline{a} + \underline{b})$

$\vec{ML} = \mu \vec{MD}$

$= \mu(2\underline{b} - \underline{a})$

$\vec{AL} + \vec{LM} = \vec{AM}$ (10)

$\lambda(2a + \underline{b}) + \mu(\underline{a} - 2\underline{b}) = \underline{a}$ (10)

$(2\lambda + \mu - 1)a + (\lambda - 2\mu)\underline{b} = 0$ (10)

$2\lambda + \mu - 1 = 0$ & $\lambda - 2\mu = 0$ (10)

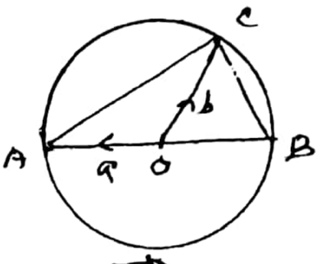
$4\mu + \mu - 1 = 0$ $\quad \lambda = 2\mu$

$\mu = \frac{1}{5}$ $\quad \lambda = \frac{2}{5}$ (10)

$AL : LN = 2 : 3$ (10)

$ML : LD = 1 : 4$ (10)

b)



(10)

$\vec{AC} = \underline{b} - a$, $\vec{BC} = \underline{a} + \underline{b}$ (10)

$\vec{AC} \cdot \vec{BC} = (\underline{b} - \underline{a}) \cdot (\underline{a} + \underline{b})$ (10)

$= b^2 - a^2$

$= 0$ (10) $\quad |\underline{a}| = |\underline{b}|$ (10)

$\therefore AC \perp \vec{BC}$

17 a)

$R^2 = P^2 + Q^2$ —— (1) (10)

$n^2R^2 = P^2 + Q^2 + 2PQ\cos\theta$ —— (2) (10)

$(n+2)^2R^2 = P^2 + Q^2 + 2PQ\sin\theta$ —— (3) (10)

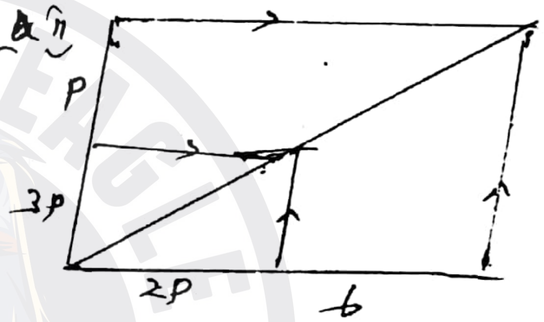
$(2) - (1) \Rightarrow (n^2 - 1)R^2 = 2PQ\cos\theta$ —— (4) (10)

$(3) - (1) \Rightarrow [(n+2)^2 - 1]R^2 = 2PQ\sin\theta$ —— (5) (10)

$\frac{(5)}{(4)} \Rightarrow \frac{(n+2)^2 - 1}{n^2 - 1} = \tan\theta$ (10)

$\frac{n+3}{n+1} = \tan\theta$ (10)

17 b)

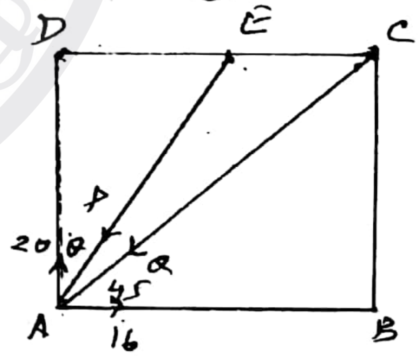


(20)

$\frac{2P}{6} = \frac{3P}{P} = 3$ (10)

$P = 9$ (10)

$\tan\theta = \frac{1}{2}$



$\rightarrow$ $16 - Q\cos45 - P\sin\theta = 0$ (10)

$16 - \frac{Q}{\sqrt{2}} - P\frac{1}{\sqrt{5}} = 0$ (5)

$\frac{P}{\sqrt{5}} + \frac{Q}{\sqrt{2}} = 16$ —— (1) (5)

$\uparrow$ $20 - P \cdot \frac{2}{\sqrt{5}} - \frac{Q}{\sqrt{2}} = 0$ (5) (10)

$\frac{2P}{\sqrt{5}} + \frac{Q}{\sqrt{2}} = 20$ —— (2) (5)

$P = 4\sqrt{5}$ (5)

$Q = 12\sqrt{2}$ (5)