১

†f±i

f~wgKv

iwk gvbe mf¨Zvi ¸i"Zc~Y© avivYv| e¯‘RM‡Z hv wKQy cwigvc‡hvM¨ Zv‡KB ejv nq iwk| cwigvcZnwmK hyM †_‡K gvby hLb µgk mf¨ I mgvRe× n‡Z _vKj, weKvk NUj MwYwZK avivYvi ZLb †_‡KB weKvk NUj cwigv‡ci| ^`bw›`b Rxe‡b Ggb †Kvb †¶Î †bB †hLv‡b cwigv‡ci c‡qvRb nq bv| 5m, 3s, 12 Taka, 5ml, 6⁰C BZ¨w` Øviv h_vµ‡g e¯‘i %`N¨, mgq, UvKv, AvqZb Ges Zvcgvbvi cwigvc †evSvb nq| Gme cwigv‡ci Rb¨ †Kej gvÎ GKK mn cwigvY D‡ল্লখ Kiv n‡q‡Q| Avevi hw` ejv nq GKwU †jvK GK we›`y †_‡K hvÎv K‡i c_‡g 4m c‡i Av‡iv 5mm `~iZ AwZµg K‡i‡Q| Zvn‡j hvÎv we›`y †_‡K †m me‡kl KZ `~‡i Av‡Q G c‡ki DËi ïay `~iZ `w‡q wbiæU †hvM Ki‡j cvIqv hv‡e bv|

cwZ chv‡q AwZµvš— `~iZ †Kvb w`‡K n‡q‡Q ejv c‡qvRb| A_vr G †¶‡Î ïay cwigvY D‡ল্লখ KivB h_vh_ bq; w`K I D‡ল্লখ Ki‡Z n‡e|

†h iwk †KejgvÎ GKK mn cwigvY wb‡`©k K‡i Zv‡`i‡K wbw`©K ev †¯‹jvi iwk Ges †h me iwk‡K m¤úY©i|‡c cKv‡ki Rb¨ Zvi cwigvY Ges w`K DfqB c‡qvRb Zv‡K †f±i ev mw`K iwk e‡j| miY, †eM, ZiY, IRb, ej BZ¨w` c‡Z¨‡KB †f±i iwk|

c`v_ weÁvb Aa¨q‡b †f±i iwki ¸i"Z Acwimxg| MwZwe`¨v, ejwe`¨v †_‡K ïi" K‡i AvaywbK c`v_ weÁvb PPvq, D”PZi MwY‡Zi PPvq †f±i Acwinvh| †f±i iwki MwYwZK cKvk, we‡শ্লষন, †hvRb we‡qvRb, †f±i ¸Yb, †f±i e¨eKjb BZ¨w` wb‡q M‡o †f±i exRMwYZ| GB BDwb‡U †f±i cKv‡ki wPý ev ixwZ, wewfb cKvi †f±i I mg‡qi mv‡c‡¶ †f±i e¨eKjb wb‡q Av‡jvPbv Kiv n‡q‡Q|

cvV-1
†f±i wb‡`kbv, cKvi‡f`, GKK †f±i

D‡Ïk¨
G cvV †k‡l Avcwb

- R¨vwgwZK wPÎ Ges MwYwZK cZxK‡Ki mvnv‡h¨ †f±i iwk cKvk Ki‡Z cvi‡eb,
- R¨vwgwZK wPÎ G‡K †f±i wb‡`wkZ †iLvsk Ges Gi Zvrch e¨vL¨v Ki‡Z cvi‡eb,
- wewfb cKvi †f±‡ii bvg ej‡Z I Zv‡`i msÁv w`‡Z cvi‡eb,
- R¨vwgwZK wP‡Îi mvnv‡h¨ wewfb cKvi †f±‡ii avi Yv e¨vL¨v Ki‡Z cvi‡eb|

1.1.1 : †f±i iwk I †f±i wb‡`kbv

‡h mg¯ †fŠZ iwk‡K m¤ú~Y©fv‡e cKv‡ki Rb¨ Zvi cwigvY I w`K Df‡qi c‡qvRb nq, Zv‡K †f±i ev mw`K iwk e‡j| miY, †eM, ZiY, lRb, ej BZ¨vw` †f±i iwk| †f±i iwk‡K R¨vwgwZK wPÎ A_ev MwYwZK cZxK Øviv wb‡`k Kiv nq| cv_wgK Ges mnRfv‡e †f±i iwk Dcjwäi Rb¨ R¨vwgwZK wP‡Îi gva¨‡g †f±i Dc¯vcbB DËg| Avmby Avgiv R¨vwgwZK Dcv‡q †f±i Abyave‡bi †Póv Kwi| R¨vwgwZK c×wZ‡Z w`K wb‡`wkZ †iLvsk Øviv †f±i eSv‡bv nq|

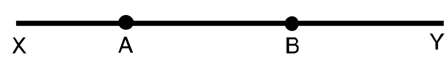
R¨vwgwZ kv‡¯ †Kvb mij †iLvi GK cvš‡K Awv`we›`y (initial point) Ges Aci cvš we›`y‡K cvšwe›`y (terminal point) wnmv‡e wPwýZ Ki‡jB H mij †iLv GKwU w`K wb‡`wkZ †iLvsk (directed line segment) n‡e|

†Kvb w`K wb‡`wkZ †iLvs‡ki Awv` we›`yA Ges cvš we›`yB n‡j H †iLvsk‡K **AB** Øviv mwPZ Kiv nq| **AB** I **BA** ci¯úi wecixZ w`K wb‡`wkZ †iLvsk KviY **AB** Gi Awv` we›`yA I cvš we›`yB. wKšz **BA**Gi Awv` we›`yB Ges cvš we›`yA| myZivs c‡Z¨K w`K wb‡`wkZ †iLvsk GKwU †f±i| c‡Z¨K w`K wb‡`wkZ †iLvsk ev †f±‡ii mv‡_ Zvi wZbwU cwiPq RwoZ|

1. ˆ`N¨ t** **AB** †iLvs‡ki ˆ`N¨ **A I **B** we›`yi ga¨eZx `~iZ |AB| Øviv mwPZ| myZivs |AB| = |BA|

2. aviK †iLv t †Kvb mij †iLvi GKwU Ask Øviv †Kvb †f±i mwPZ n‡j H †iLv‡K H †iLvsk Z_v †f±‡ii avi K †iLv e‡j| wP‡Î AB †iLvs‡ki avi K xy|

3. w`K ev fve t** **AB** Gi w`K ej‡Z "A ‡_‡K B" Ges **BA Gi w`K ej‡Z "B ‡_‡K A" eySvq myZivs w`K wb‡`wkZ †iLvs‡ki w`K Zvi ÔÔAwv` we›`y†_‡K cvš we›`ýy †evSvq|



wPÎ 1.1 : avjK †iLv

ZvB **AB** I **BA** †iLvskØ‡qi ˆ`N¨ I avjK †iLv GKB n‡jI w`K GK bq|

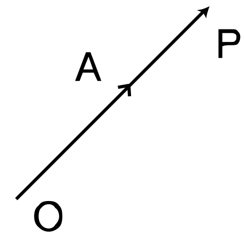
myZivs c‡Z¨K w`K wb‡`wkZ †iLvsk ev c‡Z¨K mw`K iwk ev c‡Z¨K †f±i iwk cKv‡ki Rb¨ iwki ˆ`N¨, avjK †iLv Ges w`K c‡qvRb|

1.1.2 †f±i cZxK

R¨wgwZK Dcv‡q †Kvb †f±i‡K GKwU Zxi wPwýZ A_vr w`K wb‡`wkZ †iLvsk Øviv wb‡`k Kiv nq| wPÎ 1.2 G OP GKwU †iLvsk| Gi O †K Aw` we›`y Ges P †K cvš— we›`y a‡i $\overrightarrow{OA}$ GKwU †f±i wb‡`k Kiv n‡q‡Q| G‡K wewfbfv‡e cZ‡Ki gva¨‡g cKvk Kiv hvq| Zv nj

1. OP †f±i‡K †gvUv A¶i Øviv †hgb **OP**
2. OP †f±i‡K w`K wb‡`kK Zxi wPý Øviv †hgb $\overrightarrow{OA}$

   msw¶ßfv‡e OP †f±iwU‡K A Øviv wb‡`k Ki‡j G‡K nv‡Z †jLvi mgq wb‡Pi wZb Dcv‡q cKvk Kiv nq|



wPÎ 1.2 : †f±‡ii R¨wgwZK cKvk

K. iwkwUi Dci Zxi wPý w`‡q, †hgb $\vec{A}$

L. iwkwUi Dci †iLv wPý w`‡q, †hgb $\overline{A}$

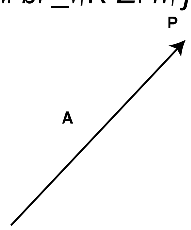
M. iwkwUi wb‡P †iLv wPý w`‡q, †hgb A̲

Qvcvi †¶‡Î Dc‡ii wZb Dcvq Qvov iwkwU‡K †gvUv (Bold) A¶‡i wj‡L †f±i cKvk Kiv nq| †hgb **A** wKšzmi“ nid A w`‡q †Kej Gi gvb †evSvb nq| GKK †f±i †jLvi mgq nv‡Zi †jLvi †¶‡Î †f±‡ii Avi I GK ai‡bi (Avjv`v) ms‡KZ e¨eüZ nq| Zv n‡”Q A¶‡ii Dci Zxi wP‡ýi cwie‡Z Ukc (hat) wPý (^)| †hgb â (Ab‡”Q` 1.1.3 G †`Lyb)| G BDwb‡U Avgiv Qvcv (eo) Ges †gvUv (Bold) A¶‡i †f±i cKvk Kie|

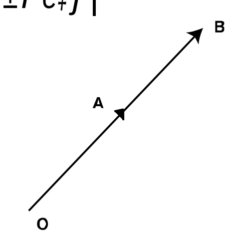
1.1.3 wewfb cKvi †f±i

1. gy³ †f±i (Free Vector) : †Kvb †f±i iwki Aw` we›`y†Kv_vq n‡e Zv hw` B”QvgZ cQ›` Kiv hvq Z‡e †mB †f±i‡K ¯vaxb ev gy³ †f±i e‡j|

2. e× †f±i (Localised Vector) : ‡Kvb †f±i iwki Aw` we›`y Ae¯vb hw` wbw`ó _v‡K A_vr B”QvgZ cQ›` Kivi my‡hvM bv _v‡K Zv n‡j †mB †f±i‡K mxgve× ev e× †f±i e‡j|



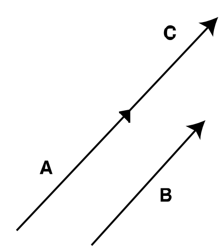
wPÎ 1.3 : gy³ †f±i



wPÎ 1.4 : e× †f±i

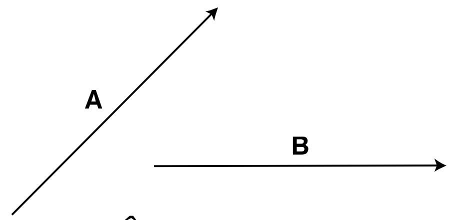
wP‡Î 1.3 G **A** †f±iwUi Aw` we›`y mybw`ó bq wKšzwPÎ 1.4 Gi **A** †f±iwUi Aw` Ges cvš— we›`y h_vµ‡g O Ges B mybw`ó| ZvB Giv h_vµ‡g gy³ I e× †f±i|

3. m`„k †f±i (Like Vector) :** mgRvZxq `yB †f±‡ii w`K GKB, Zv‡`i avivK †iLv GKB †iLv A_ev mgvšivj †iLvi Dci _vK‡j Zv‡`i ci¯úi m`„k †f±i e‡j| G‡`i mgvšivj †f±i I ejv nq| wPÎ 1.5 G **A** Ges **C** †f±i `yB m`„k (KviY GKB w`K Ges GKB avivK †iLvq); **A I **B** A_ev **A,C** I **B** c‡Z¨‡K m`„k (KviY GKB w`K Ges mgvšivj avivK †iLv)|



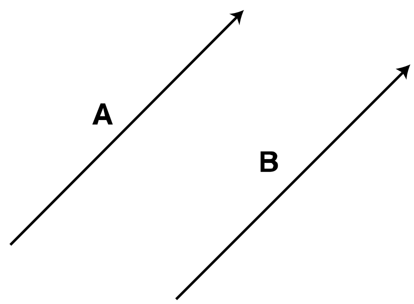
wPÎ 1.5 : m`„k †f±i

4. wem`„k †f±i (Unlike Vector) :** *mgRvZxq `yÕwU †f±i GKB w`‡K wµqv bv Ki‡j A\_vr m`„k bv n‡j Zv‡`i wem`„k †f±i e‡j| wPÎ 1.6-G* **A *Ges* **B** *†f±i `yÕwU wem`„k|*



wPÎ 1.6 : wem`„k †f±i

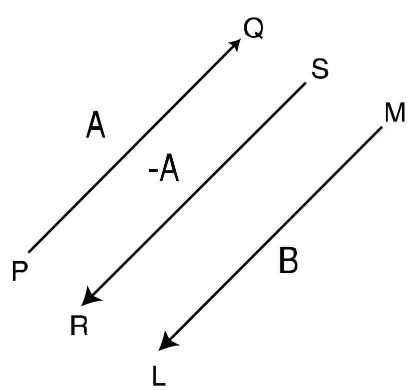
5. mgvb †f±i (Equal Vector) : *`yÕwU m`„k †f±‡ii gvb mgvb n‡j A_vr mgRvZxq `yÕwU †f±‡ii w`K GKB Ges Zv‡`i aviK †iLv GKB †iLv A\_ev mgvšÍivj †iLvi Dci n‡j G‡`i mgvb †f±i ejv nq| wPÎ 1.7-G †f±i* **A** *Ges* **B** *mgvb| KviY* |A| = |B| *Ges Giv m`„k| mgvb †f±‡ii Aw`` we›`y Ae¯'vb GKB n‡Z n‡e Ggb †Kvb K_v bvB|*



wPÎ 1.7 : mgvb †f±i

6. wecZxc †f±i (Reciprocal Vector): *`yÕwU mgvšÍivj †f±‡ii GKwUi gvb AciwUi wecixZ msL¨vi mgvb n‡j Zv‡`i wecZxc †f±i e‡j|*

7. FYvZK †f±i (Negative Vector): *wbw`ó w`K eivei †Kvb †f±i‡K abvZK ai‡j Zvi wecixZ w`‡K mgRvZxq mggv‡bi †f±i‡K FYvZK ev wecixZ †f±i e‡j|* **A** *GKwU †h †Kvb †f±i n‡j hw` Aci GKwU †f±i* **B** *Ggb nq hv‡Z* **A = - B** *nq, Zvn‡j* **B** *†K* **A** *†f±‡ii wecixZ ev FYvZK †f±i e‡j| `yÕwU †f±i ci¯úi wecixZ n‡e hw` Zv‡`i ˆ`N¨ mgvb nq, aviK †iLv GKB ev mgvšÍivj nq wKšÍ w`K wecixZ nq|*



wPÎ 1.8 : FbvZK †f±i

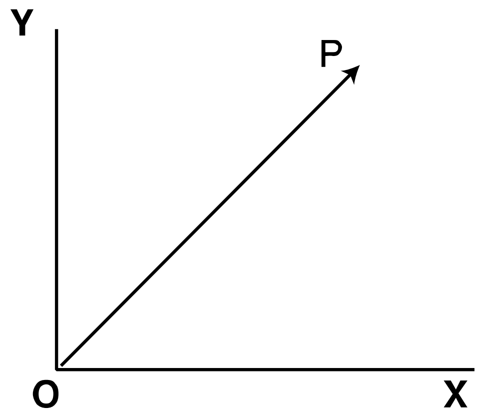
8. bvj †f±i ev kb¨ †f±i (Null or Zero Vector) : *†h †f±‡ii gvb kb¨ Zv‡K kb¨ ev bvj †f±i e‡j Ges* **O** *cZxK Øviv m~PZ nq| GKwU †f±‡ii mv‡_ Zvi wecixZ †f±i †hvM K‡i ev `yÕwU mgvb †f±i we‡qvM K‡i bvj †f±i cvIqv hvq| bvj †f±‡ii †Kvb w`K bvB (1.3 Ab¨‡Q‡` D`vniY mn Av‡jvPbv Kiv n‡e)|*

9. mwVK †f±i (Power Vector): *†h mKj †f±‡ii gvb kb¨ bq Zv‡`i‡K mwVK †f±i e‡j|*

10. GKK †f±i (Unit Vector): †Kvb †f±‡ii gvb GKK n‡j Zv‡K GKK †f±i e‡j| GKwU mwVK †f±i‡K Zvi gvb w`‡q fvM Ki‡j GKK †f±i cvIqv hvq|

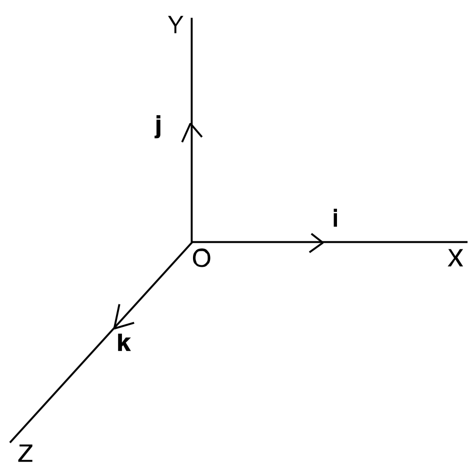
aiv hvK, **A** GKwU †f±i wKšz |**A**| $\neq$ **0** Zvn‡j $\frac{\mathbf{A}}{|\mathbf{A}|}$ = **a** (awi)| **a** †f±‡ii gvb GKK Ges w`K **A** Gi w`‡K| GwU GKwU GKK †f±i| †f±i Av‡jvPbvq GKK †f±‡ii ¸i"Z Acwimxg| GRb¨ GKK †f±i cKv‡ki Rb¨ Avjv`v ms‡KZ e¨envi Kiv nq| Zv nj A¶iwUi Dci GKwU Uzc (cap) wPý (^) †hgb $\hat{a}$. $\hat{b}$ BZ¨vw` |

11. Ae¯'vb †f±i (Position Vector): wØgwÎK cm½ KvVv‡gvi g~j we›`y mv‡c‡¶ †Kvb we›`y Aew¯'wZ †h †f±i w`‡q eY©bv nq Zv‡K Ae¯'vb †f±i e‡j| wPÎ 1.9-G O nj x, y A‡¶i †Q` we›`yA_vr cm½ KvVv‡gvi g~j we›`y| P †h †Kvb GKwU we›`y| OP ‡f±iwU O we›`y mv‡c‡¶ P we›`y Ae¯'vb wb‡`k K‡i| GLv‡b **OP** GKwU Ae¯'vb †f±i| Ae¯'vb †f±i‡K A‡bK mgq e¨vmva †f±iI (radius vector) e‡j| G‡K **r** Øviv cKvk Kiv nq| myZivs **OP = r**



wPÎ 1.9 : Ae¯'vb †f±i

12. **AvqZ GKK †f±i (Rectangular Unit Vector)** : wZbwU A¶ x, y, z hw` ci¯ú‡ii mv‡_ j¤fv‡e Ae¯'vb K‡i Zvn‡j Zv‡K Avgiv wÎgwÎK AvqZ ¯'vbvsK e¨e¯'v (Three Dimensional Rectangular Co-ordinate System) ewj| GKwU wÎgwÎK AvqZ ¯'vbvsK e¨e¯'vq wZbwU abvZK A¶ eivei hLb wZbwU GKK †f±i we‡ePbv Kiv nq ZLb Zv‡`i‡K AvqZ GKK †f±i e‡j| wÎgwÎK ¯'vbvsK e¨e¯'vq AvqZ GKK ¸wj‡K $\hat{i},\hat{j},\hat{k}$ Øviv cKvk Kiv nq|



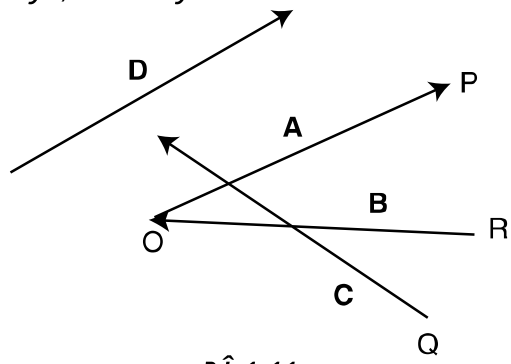
wPÎ 1.10 : AvqZ GKK †f±i

abvZK X A¶ eivei GKK †f±i‡K **i**, abvZK **Y** A¶ eivei GKK †f±i‡K $\hat{j}$ Ges abvZK A¶ eivei GKK †f±i‡K $\hat{k}$ aiv nq| $\hat{i},\hat{j},\hat{k}$ G wZbwU GKK †f±i‡K AvqZ GKK †f±i wnmv‡e MY¨ Kiv nq| **x** A¶ eivei 5 GKK †f±i _vK‡j †mwU n‡e **5**$\hat{i}$, GKB fv‡e Y I Z A¶ eivei 3 I 9 GKK †f±i _vK‡j †m¸wj n‡e h_vµ‡g 3$\hat{j}$ Ges 9$\hat{k}$ |

cv‡VvËi gj~¨vqb
mwVK DËiwU‡Z wUK wPý (√) w`b|

1| cv‡ki wP‡Î †Kvb †f±iwUi Awf` we›`yO, cvš— we›`yP

K. **A**
L. **B**
M. **C**
N. **D**



wPÎ 1.11 :

2| †KvbwU †f±i cZxK bq|

K. **A**

L. $\overrightarrow{A}$

M. $\overleftrightarrow{A}$

N. $\overline{A}$

3| †Kvb †f±‡ii Awf` we›`y†Kv_vq n‡e Zv h_` B"QvgZ cQ›` Kiv hvq Zvn‡j Zv‡K wK e‡j?

K. ¯'vaxb †f±i   L. Awf` †f±i
M. gy³ †f±i   N. Ae¯'vb †f±i

4| `yÕwU mgvb †f±‡ii Rb¨ †KvbwU Acwinvh©

K. Df‡qi w`K mgRvZxq n‡Z n‡e   L. Df‡qi gvb mgvb n‡Z n‡e|
M. Df‡qi Awf` we›`yGKB n‡Z n‡e   N. Df‡qi gvb I w`K GKB n‡Z n‡e

5| **U** Ges **V** †f±i `yÕwU wecixZ nIqvi kZ© †KvbwU

K. $|\mathbf{u}| \neq |\mathbf{v}|$
L. **U** Ges **V** Gi avi‡K †iLv Aek¨B GKB n‡e
M. **U** Ges **V**Gi w`K Gi w`‡Ki wecixZ n‡Z n‡e|
N. **U** Ges **V** mgvb n‡Z n‡e

6| cm½ Kv‡Vv‡gvi gy³ we›`y mv‡c‡¶ †Kvb we›`yi Ae¯'vb wb‡`©kK †f±i‡K wK e‡j?

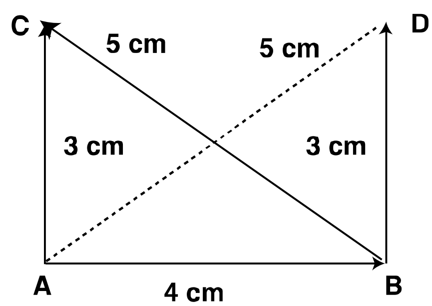
K. AvqZ †f±i   L. GKK †f±i
M. e¨vmva© †f±i   N. mv‡c‡¶ †f±i

cvV - 2
†f±i ivwki †hvM

D‡Ïk¨
G cvV †k‡l Avcwb -

- †f±i ivwki †hvM Ges †¯‹jvi ivwki †hv‡Mi cv_K¨ e¨vL¨v Ki‡Z cvi‡eb,
- †f±i †hv‡Mi dj A_vr jwä †f±i Ges jwä †f±‡ii Dcvsk Kv‡K e‡j Zv ej‡Z cvi‡eb,
- †f±i †hv‡Mi wÎfR m~Î, mvgšÍwiK m~Î Ges eûfR m~Î eYbv I e¨vL¨v Ki‡Z cvi‡eb,
- †f±i †hv‡Mi m~Îmgn~ c‡qvM K‡i mgm¨v mgvavb Ki‡Z cvi‡eb|

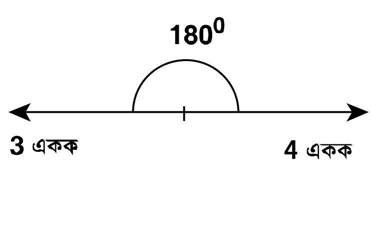
1.2.1 †f±i †hv‡Mi avibv I msÁv



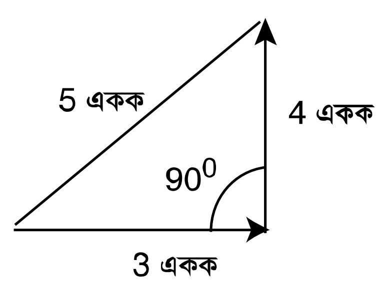
wPÎ 1.12 : †f±‡ii †hvM

`yB ev Z‡ZvwaK †¯‹jvi ivwk †hv‡Mi wbqg‡K ejv nq exRMwY‡Zi mvavib †hvM| †hgb 5kg, 7kg, 3kg ‡hvM Ki‡j dj nq 15kg| G‡¶‡Î mgm¨v mgvav‡bi wbqg n‡jv 5kg+7kg+3kg = 15kg| wKšZ †f±i ivwki †¶‡Î Gi|c wbq‡g †hvM Ki‡j wK nq †`Lv hvK, wPÎ 1.12 j¶¨ Ki"b| aiv hvK GKwU KYv A †_‡K 4cm m‡i B‡Z †Mj Gici BC eivei 5cm `~iZ AwZµg Kij| G†¶†Î KYwUi miY nj AC|

AC = 3cm wKšZ 5+4=9cm bq| Avevi KYwU hw` A ‡_‡K B we›`y‡Z hvIqvi ci B †_‡K j¤fv‡e 3cm `~‡i D we›`y‡Z †hZ Zvn‡j AB Ges BD †f±i `yÕwi exRMwYwZK †hvM nZ 4+3=7cm| wKšZA †_‡K D Gi cKZ.`~iZ n‡e 5cm| wPÎ †_‡K †`Lv hv‡"Q AC Ges AD mgvb bq| GLv‡b ivwk `yÕwi †hvMdj gvb I w`‡Ki m‡½ RwoZ _vKvq Zv‡`i †hvMdj 1 †_‡K 7 chš n‡Z cv‡i| hLb †f±i `yÕ ci¯úi wecixZ w`‡K A_vr Zv‡`i g‡a¨ †Kv‡Yi cwigvY 180° ZLb †hvMdj n‡e 1 GKK| hLb Df‡qi g‡a¨ †Kv‡Yi cwigvY 90° A_vr ci¯úi j¤ ZLb †hvMdj n‡e 5 GKK|



wPÎ 1.13 :



wPÎ 1.14 :

wPÎ 1.15 :

Avevi Df‡qi g‡a¨ †Kv‡Yi cwigvY k~b¨ n‡j A_vr †f±i `yÕ GKB aviK †iLvq Ges GKB w`‡K _vK‡j †hvMdj n‡e 7 GKK| Gfv‡e 3 GKK I 4 GKK `yÕ †f±‡ii AmsL¨ †hvMdj n‡Z cv‡i| GLv‡b j¶Yxq welq n‡jv `yÕ †f±‡ii g‡a¨ †Kv‡Yi cwigvY| A_vr, †f±i ivwkØ‡qi †hvMdj ïaygvÎ Zv‡`i gv‡bi Dci bq GKB m‡½ w`K ev Zv‡`i ga¨eZx †Kv‡Yi Dci wbfi K‡i| Kv‡RB †f±i ivwki †hvM mvaviY exRMwY‡Zi wbq‡g Kiv hvq bv| R¨vwgwZK Dcv‡q Ki‡Z nq| †f±‡ii †hvM, we‡qvM, ¸Y cfwZ.m¤wjZ MwY‡Zi kvLv‡K †f±i exRMwYZ ejv nq| MwY‡Zi GB kvLvq †f±i iwk mg‡ni †hvM, we‡qvM, ¸Y BZ¨vw` wewfb m-Î I wbqgvejx Av‡jvPbv Kiv nq|

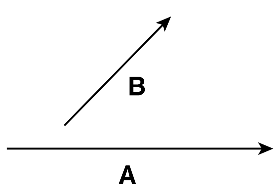
`yB ev Z‡ZvwaK GK RvZxq †f±i †hvM Ki‡j GKwU bZzb †f±i cvIqv hvq| GwU সংশ্লিষ্ট †f±i ¸wji mgwó ev †f±i iwki jwä| †h †f±i¸wj †hvM K‡i †f±i jwä cvIqv hvq Zv‡`i c‡Z¨K‡K ejv nq jwäi Dcvsk| GKwU jwä †f±‡ii `yB ev Z‡ZvwaK †h †Kvb msL¨K Dcvsk _vK‡Z cv‡i| Aevi GKB msL¨K Dcvsk¸wji g‡a¨ †Kv‡Yi cwigvY wewfb n‡Z cv‡i| wKšzj¶¨ ivL‡Z n‡e †hv‡Mi Rb¨ †f±i iwk¸‡jv Aek¨B GK RvZxq n‡Z n‡e|

wewfb R¨vwgwZK c×wZ‡Z `yB ev Z‡ZvwaK †f±‡ii †hvM ev jwä wbYq Kiv nq| Avgiv Avgiv GLv‡b wZbwU c×wZ Av‡jvPbv Kwi|

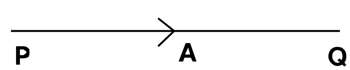
1.2.2 †f±‡ii †hv‡Mi wÎfR m-Î (Law of Triangle)

`ywU †f±‡ii †hv‡Mi †¶‡Î GKwU †f±‡ii cvšwe›`yZ Aci †f±‡ii Awì we›`y¯'vcb K‡i c_‡g †f±i `ywU mgZ‡j AvKv nq| AZ:ci c_g †f±‡ii Awì we›`yGes wØZxq †f±‡ii cvš we›`y‡hvM Ki‡j †h †iLv cvIqv hvq Zvi ^`N¨ jwäi gvb Ges c_g †f±‡ii Awì we›`y‡_‡K wØZxq †f±‡ii cvš we›`yi w`K n‡e jwäi w`K|

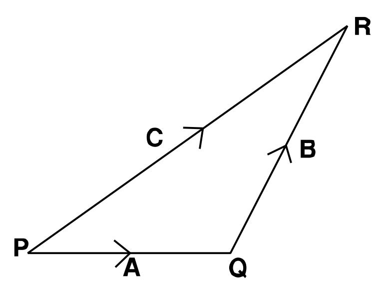
D`vniY t aiv hvK **A** I **B** Gi jwä †ei Ki‡Z n‡e| jwä †ei Kivi Rb¨
(i) mgZ‡j **A** †f±iwU ¯'vcb Ki"b| **A** †f±‡ii Awì we›`yP I cvš we›`yQ wPwýZ Ki"b|
(ii) Q we›`y‡Z **B** ‡f±‡ii Awì we›`y¯'vcb K‡i †f±iwU AuvKzb| Gi cvšwe›`yR wPwýZ Ki"b|



wPÎ 1.16 (K)



wPÎ 1.16 (L)



wPÎ 1.16 (M)

(iii) PR hy³ Ki"b|

Zvn‡j **A** I **B** †f±i `ywUi jwäi gvb n‡e PQ Gi ^`N¨ Ges w`K n‡e P †_‡K R Gi w`‡K A_vr ejv †h‡Z cv‡i

PQ +QR =PR

ev, **A**+ **B** = **C** [GLv‡b PR = **C** aiv nj]

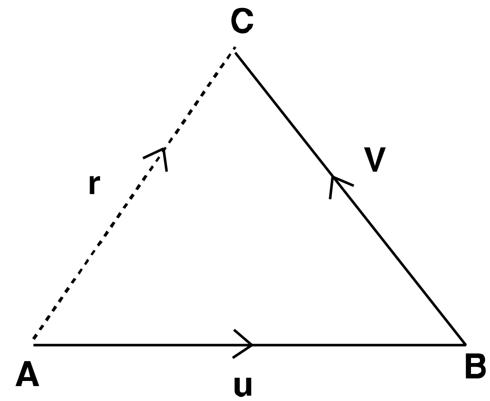
†f±i †hv‡Mi GB c×wZ‡K e‡j wÎfR m-Î| m-ÎwU‡K Gfv‡e †jLv hvq-

†f±i †hv‡Mi wÎfR m-Î t hw` †Kvb wÎfz‡Ri mwbœwnZ `ywU evû GKB µ‡g `ywU †f±i iwk‡K wb‡`k K‡i, Zvn‡j wÎfz‡Ri ZZxq evûwU wecixZ µ‡g †f±iØ‡qi jwäi gvb I w`K wb‡`k K‡i|

†Póv Ki"b t wP‡Î ABC GKwU wÎfR -Gi AB eivei **u** †f±i Ges BC eivei **v** †f±i wb‡`k Ki‡Q| **u** + **v** = KZ?

DËi ms‡KZ t AC †hvM Ki"b| AC n‡e **u** + **v** Gi mgvb, w`K n‡e A †_‡K C eivei| aiv hvK jwä †f±i **r**|

∴ **r** = **u** + **v**

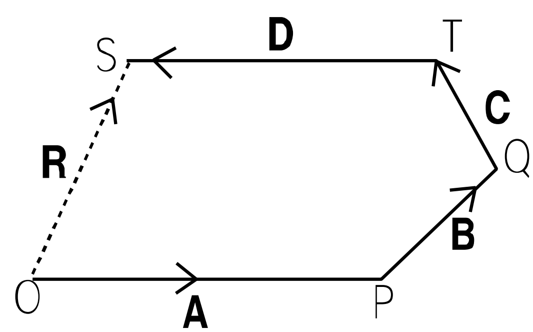


wPÎ 1.17

1.2.3 †f±i †hv‡Mi eûfR wewa

`y‡qi Gi †ewk †f±‡ii jwä wbY©‡qi †¶‡Î c_‡g †h †Kvb GKwU †f±i AuK‡Z n‡e| Zvici µgvb‡q Ab¨ †f±i¸‡jv Ggbfv‡e ¯'vcb Ki‡Z n‡e hv‡Z K‡i GKwU †f‡±ii cvš—we›`y Dci cieZx †f±‡ii Aw` we›`y_v‡K| Gici c_g †f‡±ii Aw` we›`yGes †kl †f‡±ii kxl we›`y†hvM K‡i †h mij †iLv cvIqv hvq Zvi ˆ`N¨ †f±i jwäi gvb wb‡`k K‡i| jwäi w`K n‡e c_g †f‡±ii Aw` we›`yn‡Z †kl †f‡±ii cvš— we›`y w`‡K|

D`vniY t wPÎ 1.18 j¶¨ Ki"b **A,B,C,D** PviwU †f±‡ii †hvMdj n‡e **OS=R** †f±i| †f±i †hv‡Mi GB c×wZ‡K ejv nq eûfR m~Î|



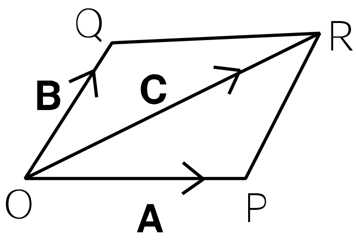
wPÎ 1.18

†f±i †hv‡Mi eûfR m~Î t `yB Ges Z‡ZwaK †f±‡ii †¶‡Î GKB µ‡g †f±i¸‡jv‡K mwR‡q c_g †f‡±ii Aw` we›`yGes †kl †f‡±ii cvš— we›`y†hvM K‡i GKwU eûfR ˆZwi Ki‡j eûf‡Ri †kl evûwU wecixZµ‡g †f±i jwäi gvb I w`K wb‡`k K‡i|

1.2.4 †f±i †hv‡Mi mvgšÍwiK m~Î

`ywU †f±i †Kvb GKwU we›`y‡Z KvR Ki‡j †f±iØq mwbœnZ evû a‡i mvgšÍwiK G‡K jwäi gvb I w`K wbY©q Kiv hvq| G‡¶‡Î H we›`y `‡q AswKZ KY †f±i jwäi gvb I w`K wb‡`k K‡i| GB cwµqvq †f±i †hv‡Mi MwYwZK m~Î cwZôv Kiv hvq|

mvgšÍwiK m~Î t hw` †Kvb mvgšÍwi‡Ki `ywU mwbœnZ evû Øviv †Kvb KYvi Dci GKB mv‡_ wµqvkxj GKB RvZxq `ywU †f‡±ii gvb I w`K wb‡`k Kiv nq| Zvn‡j H we›`y†_‡K AswKZ mvgšÍwi‡Ki KYwU †f±i `ywUi jwäi gvb I w`K wb‡`k K‡i|



wPÎ 1.19

wP‡Î **O** we›`y‡Z **A, B** `ywU †f±i wµqvkxj| G‡`i gvb I w`K h_vµ‡g OP Ges OQ †iLv Øviv †`Lv‡bv n‡q‡Q| OP Ges OQ †K mwbœnZ evû a‡i GKwU mvgšÍwiK OPRQ cƒY© Kiv nj| OR †hvM Ki‡j, OR KY©wU **A, B** ‡f±i `ywUi jwä gvb I w`K wb‡`©k K‡i‡Q| A_©vr jwä

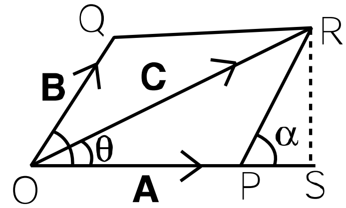
C = A+ B

A_ev **OR = OP +OQ**

mvgšÍwiK mš‚‡K Kv‡R jvwM‡q †f±i `ywUi wµqv †iLv Ges gv‡bi mv‡c‡¶ jwäi wµqv †iLv I gv‡bi MvwYwZK wnmve wbYq Kiv hvq|

aiv hvK **A, B** Gi Aš—fy©³ †KvY ∠POQ = α G¶‡Î jwä **C= OR** Ges **ORA** f±‡ii mv‡_ θ †KvY K‡i‡Q| R¨vwgwZK I wÎ‡KvYwgwZK MYbv †_‡K †`Lv‡bv hv‡e jwä gvb C= $A^2 + B^2 + 2AB\cos\alpha$

ev, $C = \sqrt{A^2+B^2+2AB\cos\alpha}$



wPÎ 1.20

Ges jwä C hw` A Gi mv‡_ θ †Kvb Drcb K‡i

A_©vr ∠POR = θ nq, Zvn‡j

$$\tan\theta = \frac{B\sin\alpha}{A+B\cos\alpha}$$

MYbwU wb‡R Ki‡Z †Póv Ki“b (bx‡Pi Ask †X‡K ivLyb)| Gevi wgwj‡q †`Lyb|

MYbv t OP †K S chš— ewaZ Ki“b| R †_‡K OP Gi ewaZvs‡ki Dci RS jš¦ AuvKyb| ∠QOP = ∠RPS = ∠α (Abyiƒc †KvY e‡j)

ΔRPS G $\sin\alpha = \frac{RS}{RP}$; $\cos\alpha = \frac{PS}{RP}$

ev, RS = RP sinα .... (1.1)

ev, PS = RP cos α ....(1.2)

Δ ORS mg‡KvYx,

AZGe $OR^2 = OS^2 + RS^2$

ev, $OR^2 = (OP+PS)^2 + (RS)^2$

ev, $OR^2 = OP^2 + 2OP.PS + (PS)^2 + (RS)^2$

ev, $OR^2 = OP^2 + 2OP.\,RP\cos\alpha + (PS)^2 + (RS)^2$

ev, $OR^2 = OP^2 + 2OP.\ RP \cos\alpha + PR^2$

ev, $OR^2 = OP^2 + 2OP.\ OQ \cos\alpha + OQ^2$ [∵ OQ = PR]

ev, $C = \sqrt{A^2 + B^2 + 2\,AB\cos\alpha}$ ....(1.3)

Avevi, Δ ROS Gi $\tan\theta = \frac{RS}{OS} = \frac{RS}{OP + PS} = \frac{RP\sin\alpha}{OP + RP\cos\alpha}$

[mgxKiY 1.1, 1.2 †_‡K gvb ewm‡q]

ev $\tan\theta = \frac{OQ\sin\alpha}{OP + OQ\cos\alpha} = \frac{A\sin\alpha}{B + A\cos\alpha}$ .... (1.4)

MYbv †_‡K cvIqv †Mj `ywU †f±‡ii gvb (A, B) I Zv‡`i ga¨eZx© †KvY (α) †`qv _vK‡j Zv‡`i jwäi gvb $C = \sqrt{A^2 + B^2 + 2\,AB\cos\alpha}$; Ges jwä A †f±‡ii m‡½ θ †KvY Ki‡j $\tan\theta = \frac{A\sin\alpha}{B + A\cos\alpha}$

cv‡VvËi g~j¨vqb

mwVK DË‡i (√) wPý w`b|

1| 4 GKK Ges 9 GKK `yB †f±‡ii jwä KLb 5 GKK †f±i n‡e?

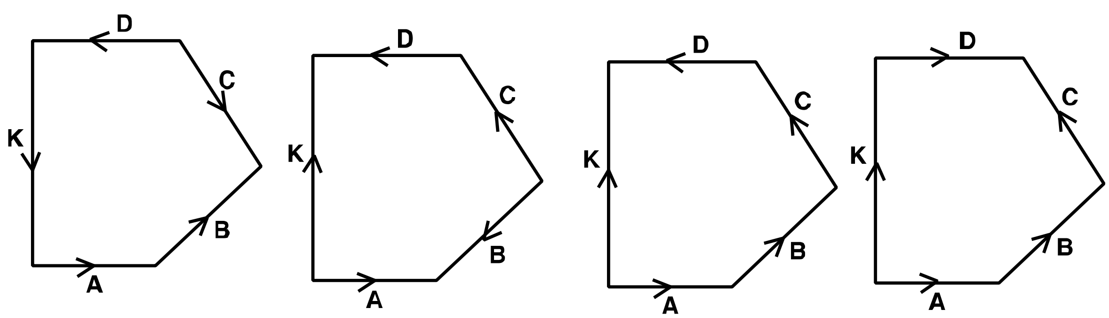
K. †h †Kvb †¶‡Î B

L. 4 GKK Ges 9 GKK †f±i `ywUi g‡a¨ †KvY hLb 0° n‡e

M. 4 GKK Ges 9 GKK †f±i `ywUi g‡a¨ †KvY hLb 90° n‡e

N. 4 GKK Ges 9 GKK †f±i `ywUi g‡a¨ †KvY hLb 180° n‡e|

2| **A** +**B** + **C** + **D** = **K** †Kvb wPÎ Øviv eySvb n‡q‡Q?



T U V W

3| 3 GKK Ges 4 GKK `yB †f±i ci¯úi j¤fv‡e GKB wei›`y‡Z wµqvkxj| G‡`i jwä †f±i KZ GKK n‡e?

K. $3^2 + 4^2 + 2.3.4 \cos \alpha$ GKK L. ($3^2 + 4^2$) GKK

M. (3 + 4) GKK N. 5 GKK

cvV -3
†f±i †hv‡Mi m~Îvejx, †f±i ivwki we‡qvM

D‡Ïk¨

G cvV †k‡l Avcwb

- †f±i exRMwY‡Zi wewbgq m~Î I ms‡hvM m~Î e¨vL¨v Ki‡Z cvi‡eb|
- MvwYwZKfv‡e cgvY Ki‡Z cvi‡eb †f±i ivwki †hvM wewbgq I ms‡hvM m~Î †g‡b P‡j|
- GKwU †f±i †_‡K Avi GKwU †f±i we‡qvM Ki‡Z cvi‡eb|

1.3.1 †f±i wewbgq I ms‡hvM m~Î

Avgiv Rvwb a, b, c †h †Kvb wZbwU ev¯—e msL¨vi Rb¨ (a+b) + c = a + (b+c) GwU GKwU MvwYwZK wewa ev wbqg| G‡K e‡j †hv‡Mi ms‡hvM wewa (Associative law of addition)| Avevi a, b †h †Kvb `yBwU ev¯—e ivwki Rb¨ a + b = b + a GwUI GKwU MvwYwZK wewa| G‡K e‡j †hv‡Mi wewbgq wewa (Commutative law of addition)| G ai‡bi †ek wKQy MvwYwZK wewa †hvM I ¸‡Yi wbqg‡K mnRZi K‡i‡Q| †f±i exRMwY‡Zi †¶‡Î I Gi|c wKQy wewa c‡hvR¨| GLv‡b Avgiv †f±i †hv‡Mi wewbgq wewa I †f±i †hv‡Mi ms‡hvM wewa wb‡q Av‡jvPbv Kie|

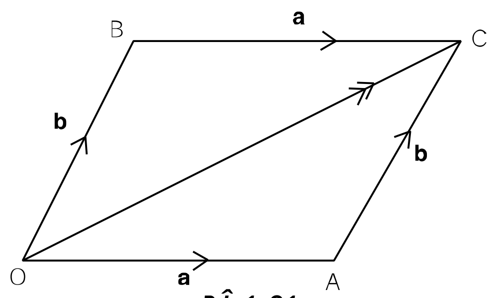
wewbgq m~Î (Commutative law)

hw` **a, b** `yBwU †f±i ivwk nq Z‡e wewbgq m~Î Abyhvqx **a** Gi m‡½ **b** ‡hvM Ki‡j †h jwä cvIqv hv‡e **b** Gi m‡½ **a** ‡hvM Ki‡j I †mB jwä cvIqv hv‡e| A_©vr

a+b = b +a .... GwUB †f±i wewbgq m~Î

e¨vL¨v t aiv hvK (wPÎ 1.21) OA mij †iLv **a** ‡f±i Ges OB mij †iLv **b** ‡f±i wb‡`©k Ki‡Q| GLb OA Ges OB ‡K mwbœnZ evû we‡ePbv K‡i OACB mvgvšÍwiKwU AsKb Kiv nj| mvgvšÍwiKwUi wecixZ evû¸wj mgvb I mgvšÍivj| myZivs

OA = BC = a Ges **OB = AC = b**



wPÎ 1.21

GLb **OA +AC = OC** .... (1.1)

Avevi **OB + BC = OC** .... (1.2)

(1.1) I (1.2) mgxKiY †_‡K, **OA + AC = OB + BC**

ev, **a + b = b + a**

A_©vr †f±i †hvM wewbgq m~Î †g‡b P‡j|

ms‡hvM m~Î (Associative law)

a,b,c wZbwU †f±i n‡j †hv‡Mi ms‡hvM wewa Abyhvqx **a +b** Gi m‡½ **c** †hvM Ki‡j †h jwä cvIqv hv‡e **a** Gi m‡½ **b + c** ‡hvM Ki‡j I †mB jwä cvIqv hv‡e; A_©vr

(a+b)+c =a +(b +c).................. GwU †f±‡ii ms‡hvM m~Î|

e¨vL¨v t wPÎ 1.21-G **a= OA, b = AB, c = BC, ab + c = BC, a** Gi Aw` we›`y O | **b** Gi kxl we›`y B †hvM Kiv n‡jv|

myZivs †jLv hvq -

a + b = OA + AB = OB

∴ **(a + b) + c = OB + BC = OC** .... (1.3)

Avevi GKB fv‡e **b + c = AB + BC = AC**

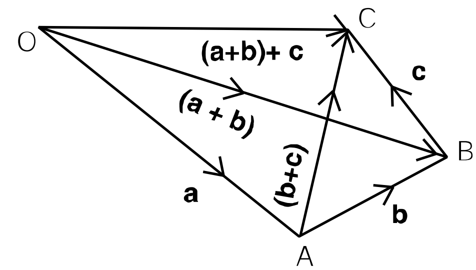
∴ **a + (b + c) = OA + AC = OC**

.... (1.4)

(1.3) Ges (1.4) mgxKiY †_‡K †jLv hvq,

(a + b) + c = a + (b + c)

A_vr †f±i †hvM ms‡hvM m~Î †g‡b P‡j|



wPÎ 1.22

1.3.2 †f±‡ii we‡qvM

GKwU †f±i †_‡K Ab¨ GKwU †f±i we‡qvM Ki‡j wK n‡e? Avmyb Gfv‡e †f‡e †`wL, GKwU abvK †f±‡ii mv‡_ GKwU FYvZK †f±i †hvM Kiv nj, Zvn‡j wK dj n‡e? GwU GKwU †f±i Ges GUvI jwä †f±i| AZGe GKwU †f±‡ii mv‡_ Ab¨ †f±‡ii FYvZK †f±iwUi †hvM KivB nj c_g †f±i †_‡K wØZxq †f±iwUi we‡qvM Kiv| aiv hvK, **a** †f±i †_‡K **b** †f±i we‡qvM K‡i **c** ‡f±i cvIqv †Mj , Zvn‡j

C = **(a – b)**

= **a + (- b)**

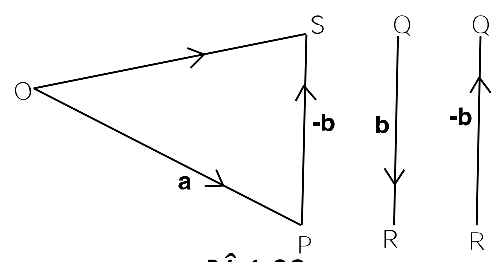
myZivs †`Lv hv‡"Q **a** †f±‡ii mv‡_ **b** ‡f±i †hvM Ki‡jB Avgiv **(a-b)** †f±i A_vr **a** Ges **b** †f±‡ii we‡qvMdj †f±i cvB|

e¨vL¨v t

aiv hvK **a** = **OP**

b = QR

Avgv‡`i $\vec{a} - \vec{b} = \vec{c}$ wbYq Ki‡Z n‡e|



wPÎ 1.23

†h‡nZzwb`ó w`K eivei †Kvb †f±i abvZK ai‡j Zvi wecixZ w`‡K mggv‡bi †f±i‡K FYvZK †f±i ejv nq|

myZivs wPÎ 1.23 Gi **-b** = **RQ** G‡K †bqv hvK|

c †f±i wbY‡qi Rb¨ **a** †f±‡ii cvš— we›`y‡Z **-b** ‡f±‡ii Aw` we›`y ¯'vcb Kiv nj| bZzb Ae¯'vb **PS = RQ = –b**

O, S †hvM Kiv n‡jv

GLb **OS = OP + PS**

= a + (-b)

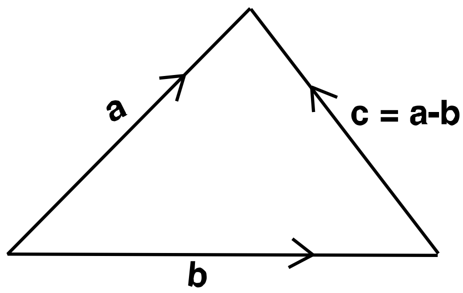
= a - b

A_vr, **c = a - b**

†f±i we‡qv‡Mi mnRZg Dcvq

i) †f±i `yÕwUi Awv` we›`yGK m‡½ ¯’vcb K‡i cvš— we›`y `yÕwU mshy³ Ki“b| (cvš— we›`y¸‡jvi ms‡hvMKvix †iLvi ‡Kvb w`K wb‡`©k Ki‡eb bv|) GB †iLvwU we‡qvMd‡ji gvb ÁvcK|

ii) **a** †_‡K **b** we‡qvM Ki‡Z n‡j **b** Gi Aš— we›`y †_‡K **a** Gi Aš—we›`y w`‡K w`K wPý w`b|
b †_‡K **a** we‡qvM Ki‡Z n‡j **a** Gi Aš— we›`y †_‡K **b** Gi Aš—we›`y w`‡K w`K wPý w`b|



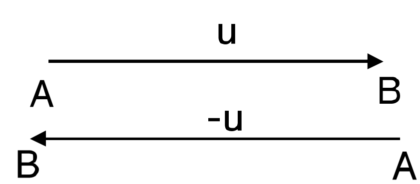
wPÎ 1.24

wPÎ 1.24 wU g‡bv‡hvMmn ch©‡eÿY Ki“b| **a - b** Gi w`K, **b-a** Gi w`‡Ki wecixZ wKšÍ Dfq †¶‡Î gvb GK|

kb¨ †f±i t 1.1.3 Aby‡”Q‡` Avgiv bvj †f±i ev kb¨ †f±‡ii msÁv D‡jøL K‡iwQ| GLv‡b kb¨ †f±‡ii Avi I wel` e¨vL¨v Kiv hvK|

ai“b **u** = **AB** †m‡¶‡Î **-u** = **BA**
Zvn‡j **u+ (-u) = AB + BA = AA = O**

c‡Z¨K †f±i w`K wb‡`©wkZ †iLvsk, wKšÍG¶‡Î **AA** †Kvb †iLvsk bq, GKwU we›`yhvi ˆ`N¨ kb¨| myZivs AA †K kb¨ †f±i aiv n‡e Ges Q cZxK Øviv mwPZ Kiv n‡e| kb¨ †f±‡ii w`K I gvb bvB|



wPÎ 1.25

cv‡VvËi g~j¨vqb

mwVK DË‡i wUK wPý (√) w`b|

1| **a, b** `ywU †f±i iwk, GLb **a + b = b + a** mgxKiYwU †Kvb bxwZ ev m~Î †g‡b Pj‡Q ?

K. †f±i †hv‡Mi wewbgq wewa
L. †f±i †hv‡Mi ms‡hvM wewa
M. †f±i †hv‡Mi e›Ub wewa
N. †f±i †hv‡Mi eRb wewa

2| **a, b, c** wZbwU †f±i iwk, **(a + b) + c = (a + b + c)** mgxKiYwU †Kvb bxwZ ev m~Î †g‡b Pj‡Q ?

K. †f±i †hv‡Mi wewbgq wewa
L. †f±i †hv‡Mi ms‡hvM wewa
M. †f±i †hv‡Mi e›Ub wewa
N. †f±i †hv‡Mi eRb wewa

3| k~b¨ †f±i wKfv‡e cvIqv hvq ?

K. †h †Kvb `yB †f±i †hvM K‡i
L. †h †Kvb `yB †f±i we‡qvM K‡i|
M. mgRvZxq `yB †f±i we‡qvM K‡i
N. `yB mgvb Ges mgRvZxq †f±i we‡qvM K‡i|

cvV-4
†f±i wefvRb I we‡শ্লষণ

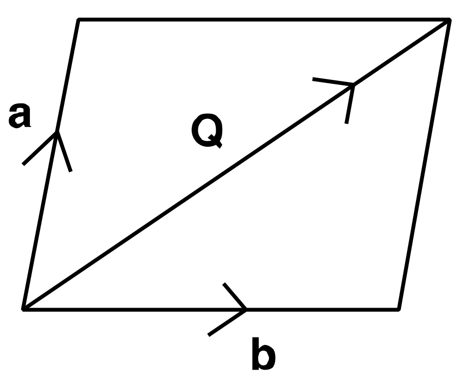
D‡Ïk¨
G cvV †k‡l Avcwb

- GKwU †f±i ivwk‡K `yB ev Z‡ZwaK †f±‡i wefvRb Kiv hvq Zv ej‡Z cvi‡eb|
- †f±i Dcvsk wbY‡qi MwYwZK m~Î cwZwôZ Ki‡Z cvi‡eb|
- j¤ Dcvsk wK Zv eYbv I e¨vL¨v Ki‡Z cvi‡eb|
- †f±i †hvR‡bi `„óvšÍ D‡ল্লখ Ki‡Z cvi‡eb|
- †f±i wefvR‡bi `„óvšÍ D‡ল্লখ Ki‡Z cvi‡eb|

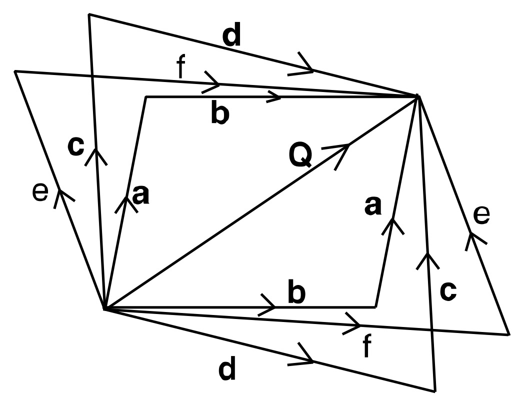
1.4.1 †f±i wefvRb

GKwU ‡f±i ivwk‡K `yB ev Z‡ZwaK ivwk‡Z wef³ Kiv hvq| †f±i ivwk‡K wef³ Kivi G c×wZ‡K †f±i wefvRb ev †f±i we‡শ্লষY e‡j| Avi wef³ Ask¸‡jv‡K gš¿ †f±‡ii Dcvsk e‡j|

GKwU we›`y‡Z `ywU †f±i (`ywU ej) KvR Ki‡j mvgšÍwi‡Ki m~‡Îi mvnv‡h¨ Zvi jwä wbYq Kivi c×wZ Avgiv †R‡bwQ| Ab¨ c‡¶ ïay GKwU †f±i (ej) †Kvb GK we›`y‡Z KvR Ki‡j G e‡ji w`K I gvb wb‡`kK †iLvsk‡K KY a‡i mvgšÍwiK G‡K GB ejwUi `ywU Dcvsk wbYq Ki‡Z cvwi (wPÎ 1.26)|



wPÎ 1.26



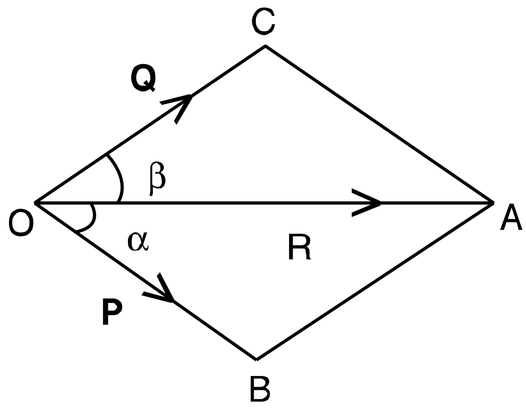
wPÎ 1.27

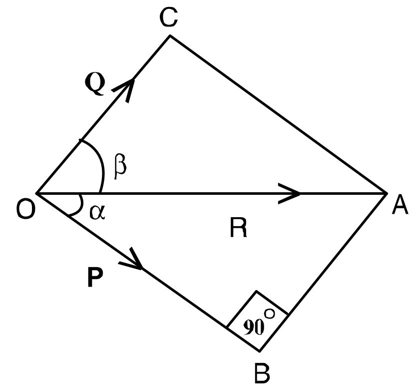
wP‡Î **Q** †f±‡ii `ywU Dcvsk **a, b** A_vr **a + b = Q**| Gevi wPÎ 1.27 j¶¨ Ki“b| GwU 1.26 wP‡Îi evaZ i|c| G‡¶‡Î **Q** †K KY a‡i wZbwU mvgšÍwiK AvuKv n‡q‡Q| m¤eZ Avcwb GLv‡b Avi I K‡qKwU, GgbwK K‡qK nvRvi mvgšÍwiK AuvK‡Z cv‡ib| **Q** KY wewkó c‡Z¨KwU mvgšÍwi‡Ki mwbwnZ evû GKB e‡ji ev †f±‡ii Dcvsk n‡e| GLv‡b ejv hvq

$$\mathbf{Q} = \mathbf{a} + \mathbf{b}$$
$$\mathbf{Q} = \mathbf{c} + \mathbf{d}$$
$$\mathbf{Q} = \mathbf{e} + \mathbf{f}$$

GB mgm¨v mgvav‡bi Rb¨ †f±‡ii Dcvsk¸wji w`K wbw`ó K‡i †bqv nq| gš¿ †f±‡ii m‡½ Dcvsk¸wji †KŠwYK we¯—vi D‡ল্লখ K‡i GB w`K wb‡`k Kiv nq| Dcvsk¸wji †KŠwYK we¯—v‡ii †hvMdj hLb GK mg‡KvY (90°) nq, ZLb Dcvsk¸wj‡K ejv nq j¤ Dcvsk Ges j¤ Dcvs‡k †f±i wefvRb‡K ejv nq j¤ we‡শ্লষণ। cieZx c„ôvi wPÎ `ywU j¶¨ Ki“b|

wPÎ (K) G OA eivei wµqviZ †f±i **R** †K OB Ges OC eivei `yÕwU Dcvsk †f±i h_vµ‡g **P** I **Q** G wefvRb Kiv n‡q‡Q| **R** Gi m‡½ **P** Dcvsk α †KvY K‡i‡Q Ges **Q** Dcvsk β †KvY Drcb K‡i‡Q| A_vr $\angle AOC = \beta$ Ges $\angle AOB = \alpha$





wPÎ 1.28(K)

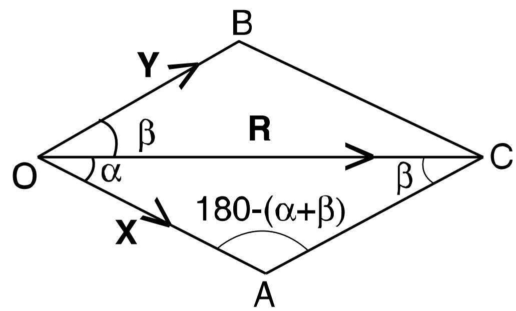
wPÎ 1.28(L)

wPÎ (L) G $\alpha + \beta = 90°$ A_vr বিশ্লিষ্টাংশদ্বয় ci¯úi j¤| GwU j¤ we‡শ্লষন।

Gevi Avmyb Dfq †¶‡Î jwä †_‡K wKfv‡e বিশ্লিষ্টাংশ wbYq Kiv hvq Zv wbY‡qi †Póv Kiv hvK|

†h †Kvb `yB w`‡K Dcvsk

aiv hvK OC ‡iLv **R** †f±‡ii gvb I w`K wb‡`k K‡i| GLb **R** †f±iwU Ggb `yÕwU Dcvs‡k wef³ Kiv nj hvi OC Gi m‡½ h\_vµ‡g $\alpha$ I $\beta$ †KvY Drcb K‡i [wPÎ 1.29]| GLb O we›`y †_‡K α I β †Kv‡Y OA Ges OB †iLv Uvbv nj| OACB mvgvšÍwiKwU cY© Ki‡j OA Ges OB evû `yÕwU **R** †f±‡ii `yÕwU Dcvsk wb‡`k Ki‡e| g‡b Kiv hvK wefwRZ Ask¸‡jv **OA** = **X** Ges **OB** = **Y** wPÎ 1.28 †_‡K,



wPÎ 1.29

$\angle BOC = \angle OCA = \beta$ Ges $\angle OAC = 180° - (\alpha + \beta)$

GLb ΔOAC wÎfzR we‡ePbv K‡i wÎ‡KvbwgwZi mƒÎ †_‡K Avgiv cvB

$$\frac{OA}{\sin\beta} = \frac{AC}{\sin\alpha} = \frac{OC}{\sin[180^0-(\alpha+\beta)]}$$

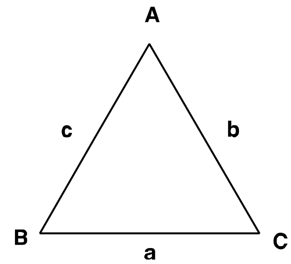
ev, $$\frac{X}{\sin\beta} = \frac{Y}{\sin\alpha} = \frac{R}{\sin(\alpha+\beta)} \quad [\because AC = OB]$$

ev, $$X = \frac{R\sin\beta}{\sin(\alpha+\beta)} \quad .... (1.5)$$

Ges $$Y = \frac{R\sin\alpha}{\sin(\alpha+\beta)} \quad .... (1.6)$$

[GLv‡b wÎ‡KvYwgwZi mvB‡bi m~Î e¨eüZ n‡q‡Q| m~ÎwU nj, wÎfy‡Ri †h †Kvb evû Ges H evûi wecixZ †Kv‡Yi sin Gi Abycv‡Z a“e A_©vr ΔABC Gi $\angle A$ Gi wecixZ evû a; $\angle B$ Gi wecixZ evû b Ges $\angle C$ Gi wecixZ evû c n‡j

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C} = \text{a“eK|}$$



wPÎ: 1.30

[Dc‡ii e¨vL¨vq Avgiv †Kej m~ÎwUi c‡qvRbxq Ask e¨envi K‡iwQ|]

j¤ Dcvsk t R †f±‡ii †K hw` mg‡Kv‡Y wefvRb Kiv nq, A_©vr Dcvsk `yÕwU hw` ci¯úi j¤ nq Zvn‡j 1.5 Ges 1.6 mgxKi‡Y $\alpha + \beta = 90°$ n‡e| †m‡¶‡Î

$$X = \frac{R\sin\beta}{\sin 90^0} = R\sin\beta$$

$$Y = \frac{R\sin\alpha}{\sin 90^0} = R\sin\alpha$$

Avevi †h‡nZz $\alpha + \beta = 90^0 \quad \because \beta = 90^0 - \alpha$

$\therefore \sin\beta = \sin(90^0 - \alpha) = \cos\alpha$

$\therefore X = R\sin\beta = R\cos\alpha$ Ges $Y = R\sin\alpha$

myZivs †Kvb †f±i **R** †K hw` ci¯úi j¤ Dcvs‡k wefwRZ Kiv nq Zvn‡j **R** Gi mv‡_ α †Kv‡Y Dcvsk X Ges X Gi mv‡_ mg‡Kv‡Y Y Dcvsk n‡j,

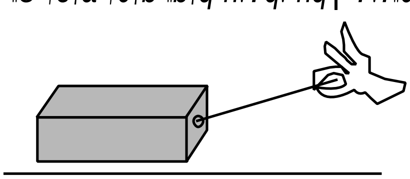
$X = R\cos\alpha$ .... (1.7)

$Y = R\sin\alpha$ ....(1.8)

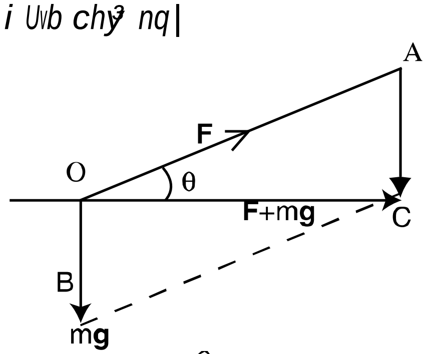
1.4.2 †f±i †hvRb I wefvR‡bi D`vniY

†f±i †hvRb I wefvRb Avgv‡`i e¨enwiK Rxe‡bi m‡½ RwoZ| wKšZ Avgiv Zv KL‡bvI Mfxifv‡e †f‡e †`wL bv| GLv‡b K‡qKwU D`vniY D‡ল্লখ Kiv nj| G ai‡bi Avi I A‡bK D`vniY Avcbviv w`‡Z cvi‡eb| Pjv‡divi mgq GKUzmZK ch©‡e¶Y Ki‡jB †`L‡eb †f±i †hvRb I wefvRb Avgv‡`i Rxeb‡K wKfv‡e cfvweZ K‡i‡Q|

1| **iwk †e‡a fvi †U‡b †bIqv t** Avgiv cvqB j¶¨ Kwi GKwU e¯‘zev fvi Mv‡Qi ¸wo, †Ljbv Mvwo BZ¨vw`-†Z `wo †e‡a †U‡b wb‡q hvIqv nq| fviwUi Dci Uvb ch©¨ nq|



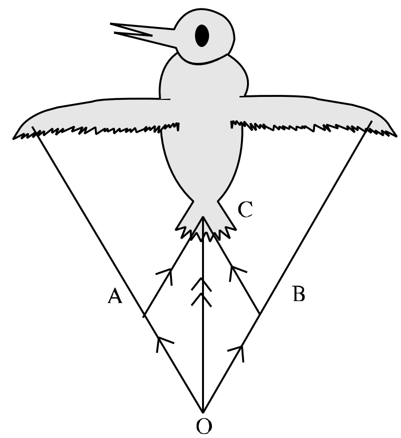
wPÎ 1.31(K)



wPÎ 1.31 (L)

†h †Kvb GKwU †Kv‡Y (wP‡Î θ)| wKšÍ e¯‘ fviwU fywgi Dci w`‡q mvg‡b GwM‡q hvq| Gi Kvib wK? **F** e‡j e¯‘i OA w`‡K Uvbv n‡"Q wPÎ 1.31(L) e¯‘i Dci cÖhy³ ej mg KvR Ki‡Q OB eivei d‡j `yÕ †f±‡ii †hvR‡bi d‡j jä †f±iwU KvR Ki‡Q fyg (OC) eive‡i| e¯‘ OC eivei GwM‡q hvq|

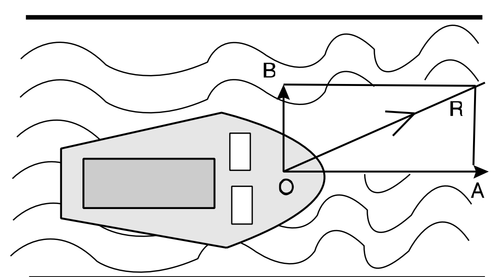
2| cvwLi Dov t cvwL AvKv‡k Dovi mgq cvLvi mvnv‡h¨ evZvm‡K AvNvZ K‡i d‡j evZvm cvwLi Dci Dëvw`‡K ej c‡qvM K‡i| wPÎ 1.32-G †`Lvb n‡q‡Q cvwLi Wvbv `yÕ O Gi w`‡K ej c‡qvM Ki‡Q| d‡j evZvm O †_‡K wecixZ w`‡K cvwLi Dci ej c‡qvM Ki‡Q GB ej `yÕ‡K **OA** Ges **OB** Øviv mwPZ Ki‡j OACB GKwU mvgvšÍwiK AvK…wZ hvq| cvwLwU GB `ywU e‡ji jwä ej **OC** eivei mgv‡bi w`‡K GwM‡q hv‡e|



wPÎ 1.32

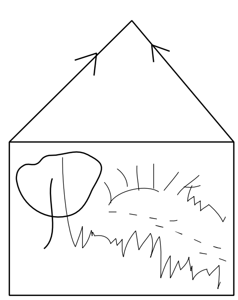
3| †bŠKvi ¸Y Uvbv : GKwU `wo w`‡q †bŠKvi m‡½ †eu‡a Zxi †_‡K †U‡b †bŠKv mvg‡bi w`‡K GwM‡q †bevi `„k¨ mevi †`Lv| G NUbv‡K I †f±i wefvR‡bi mvnv‡h¨ e¨vL¨v Kiv hvq| aiv hvK OR c‡_ `woi Uvb wµqv Ki‡Q (wPÎ 1.33)|

GB ej wefwRZ n‡q GKwU ej †bŠKv‡K ˆ`N¨ eivei mvg‡bi w`‡K GwM‡q wb‡"Q| GB Dcvsk Dcvsk **OA**| Ab¨ Dcvsk **OB** Gi wµqv nv‡ji Øviv cÖwZ³ e‡ji mvnv‡h¨ ckwgZ nq| d‡j †bŠKvwU K‚‡ji w`‡K m‡i bv wM‡q mvg‡bi w`‡K AMÖmi nq|

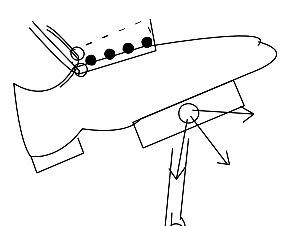


wPÎ : 1.33

Gfv‡e †f±i †hvRb I †f±i wefvR‡bi AmsL¨ D`vniY †`qv hvq| wb‡Pi wPÎ¸‡jv ch©‡e¶Y Ki"b Ges wb‡R wb‡R we‡শ্লষণ Ki"b



wPÎ 1.34 (K) †`qv‡j d‡Uv‡dg



wPÎ 1.32 (L) mvB‡Kj c¨v‡Wj

cv‡VÖi gj¨vqb

mwVK DËiwU‡Z wUK wPý (√) w`b|

1| †Kvb †f±i **u** *†K* α *Ges* β *†Kv‡Y `yw DcvsӇk wef³ Kiv n‡j wefwRZ Dcvsk¸wji gvb KZ n‡e?*

K. $\frac{R(\sin\alpha)}{\sin(\alpha+\beta)}$, $\frac{R(\cos\ \alpha)}{\cos\ (\alpha+\beta)}$

L. $\frac{u(\cos\ \alpha)}{\cos\ (\alpha+\beta)}$, $\frac{u(\sin\alpha)}{\sin(\alpha+\beta)}$

M. $\frac{u(\sin\alpha)}{\sin(\alpha+\beta)}$, $\frac{v(\sin\beta)}{\sin(\alpha+\beta)}$

N. $\frac{v(\sin\beta)}{\sin(\alpha+\beta)}$, $\frac{v(\cos\ \alpha)}{\sin(\alpha+\beta)}$

2| 5 *GKK GKwU †f±i mg‡Kv‡Y wefvRb Kiv n‡j GKwU Dcvsk GKK †f±‡ii mv‡_* 30° *†KvY Drcb K‡i| Dcvsk `ywi gvb KZ n‡e?*

K. $\frac{5}{2}$, $\frac{5\sqrt{3}}{2}$ | L. 4, 3

M. 2, $\frac{\sqrt{3}}{2}$ | N. 5, 0

cvV-5
†f±i ¸Yb I †f±i e¨eKjb

D‡Ïk¨

G cvV †k‡l Avcwb

- †f±i ivwki m‡½ †¯‹jvi ivwki ¸Y Ki‡Z cvi‡eb|
- `yw †f±i ivwki g‡a¨ `ya‡bi ¸Ydj Abyhvqx †f±i WU ev †¯‹jvi ¸Ydj I
- †f±i µk ev †f±i ¸Ydj mbv³ I wbYq Ki‡Z cvi‡eb|
- †¯‹jvi ¸Yb I †f±i ¸Y‡bi msÁv w`‡Z cvi‡eb|

1.5.1 †f±‡ii ¸Yb

†f±i ivwki †hv‡Mi g‡Zv †f±i ivwki ¸Y cwµqv I n‡Z cv‡i| †f±i ivwki ¸Yb nq `yf‡e,

1. †f±i ivwk‡K †¯‹jvi ivwk Øviv,

2. †f±i ivwk‡K †f±i ivwk Øviv|

†f±i ivwk‡K †¯‹jvi ivwk Øviv ¸Y t *aiv hvK,* **A** *GKwU †f±i ivwk, G‡K* m *GKwU †¯‹jvi ivwk Øviv ¸Y Ki‡j Avgiv* m**A** *Gi* m *¸Y cvigvY GKwU †f±i cvB| bZzb †f±iwU nq* **A** *hvi gvb* |m**A**| *Ges w`K* **A** *†f±‡ii w`‡K|* m *FYvZK n‡j* m**A** *†f±iwUi w`K nq* **A** *†f±‡ii wecixZ|*

e¯‘ fi m *GKwU †¯‹jvi ivwk, ZiY* **a** *GKwU †f±i|*

G‡`i ¸Ydj* m**a** *ej GKwU †f±i| †Kvb †f±i ivwk‡K GKwU †¯‹jvi ivwk w`‡q ¸Y Ki‡j ¸Ydj GKwU †f±i ivwk nq|

†f±i ivwk‡K †f±i ivwk Øviv ¸Y t **A** *Ges* **B** *`yw †f±i ivwk G‡`i g‡a¨ `ya‡bi ¸Y n‡Z cv‡i| d‡j ¸Ydj nq `ya‡bi| c_g a‡bi ¸‡Yi d‡j ¸Ydj nq GKwU †¯‹jvi ivwk, wØZxq Avi GK a‡bi ¸‡Yi d‡j ¸Ydj nq GKwU †f±i ivwk| c_g a‡bi ¸Y‡K ejv nq †¯‹jvi ¸Yb ev WU ¸Yb, wØZxq a‡bi ¸Y‡K ejv nq †f±i ¸Yb ev µk ¸Yb| Avmyb Avgiv D`vniY mn G `yB a‡bi †f±i ¸Yb wb‡q Av‡jvPbv Kwi|*

1.5.2 †¯‹jvi ¸Ydj ev WU ¸Ydj

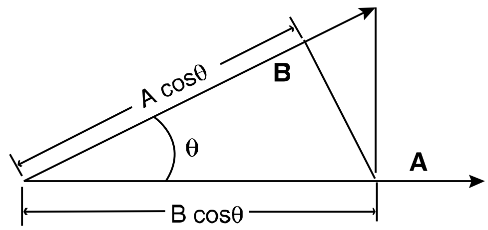
`yw †f±‡ii ¸Y‡b hw` GKwU †¯‹jvi ivwk cvIqv hvq ZLb ivwk `ywi †¯‹jvi ¸Yb ev WU ¸Yb nq Ges G ¸Ydj‡K ejv nq †¯‹jvi ¸Ydj ev WU ¸Ydj|

†¯‹jvi ¸Yd‡ji gvb, ivwk `ywi gv‡bi Ges Zv‡`i Ašf©³ ¶z`ªZi †KvYi* cosine-*Gi ¸Yd‡ji mgvb|* **A** *I* **B** *`yw †f±i ivwki g‡a¨ hLb †¯‹jvi ¸Y Kiv nq ZLb Avgiv **A** *I* **B** *Gi gvSLv‡b wes›`y (.) emvB A_vr* **A.B** *Ges cwo* **A** *WU* **B** |

A *I* **B** *`yw †f±i ivwki ga¨eZx †KvY* θ *n‡j msÁvbymv‡i †¯‹jvi ¸Ydj*

A.B= |**A**| |**B**| cosθ = AB cos θ *hLb* (θ ≤ π) .... (1.11) wKš‘ B cos θ n‡”Q **A** Gi w`‡K **B** Dcvsk ev **A** Gi Dci **B** Gi j¤ Awf‡¶c (wPÎ 1.36)|

Avevi **A·B** = AB cosθ = B(A cosθ) wKš‘ A cosθ n‡”Q **B** Gi w`‡K **A** Gi Dcvsk ev **B** Gi Dci **A**-Gi j¤ Awf‡¶c|



wPÎ 1.36

myZivs †h †Kvb `ywU †f±‡ii †¯‹jvi ¸Yb ej‡Z Avgiv †h †Kvb GKwU †f±‡ii gvb Ges †mB †f±‡ii Dci Aci †f±iwUi j¤ Awf‡¶‡ci ¸Ydj‡K eywS|

1.5.3 †f±i ¸Ydj ev µm ¸Ydj

`ywU †f±‡ii ¸Y‡b hw` GKwU †f±i iwk cvIqv hvq ZLb iwk `ywUi †f±i ¸Yb ev µm ¸Yb nq Ges G ¸Ydj‡K ejv nq †f±i ¸Ydj ev µm ¸Ydj| †f±i ¸Yd‡ji gvb nq iwk `ywUi gv‡bi Ges G‡`i Aš—fy©³ ¶z`ªZi †Kv‡Yi sin Gi ¸Yd‡ji mgvb|

A Ges **B** †f±‡ii †f±i ¸Yb Kivi mgq Avgiv **A** I **B** Gi gvSLv‡b GKwU µm (×) wPý emvB| wjwL **A** × **B** Ges cwo **A** µm **B**| †f±i ¸Yd‡ji w`K Wvb nv‡Zi ¯Œzi wbqg †_‡K cvIqv hvq|

Wvbnv‡Zi ¯Œzi wbqg t `ywU †f±‡ii mgZ‡j GKwU Wvbnv‡Zi ¯Œz‡K j¤fv‡e ¯’vcb K‡i c\_g †f±i †\_‡K wØZxq †f±‡ii w`‡K ¶z`ªZi †Kv‡Y Nywi‡q ¯Œz †h w`‡K AMÖmi n‡e †mB w`KB n‡e †f±i ¸Yd‡ji w`K|

A I **B** Gi Aš—fy©³ †KvY θ n‡j Avgiv **A** I **B** Gi †f±i ¸Y‡bi d‡j †h bZzb †f±i **C** cvB Zv nj

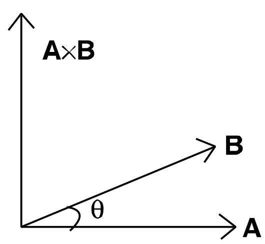
$$\mathbf{C} = \mathbf{A}\times\mathbf{B} = \mathbf{n}|\mathbf{A}|\ |\mathbf{B}|\ \sin\theta \quad [\text{hLb } 0<\theta<\pi]$$

GLv‡b **n** GKwU †f±i hv **A** × **B** A_©vr **C** Gi w`K wb‡`©k K‡i| **n**-Gi gvb 1 Ges Gi w`K Wvb nv‡Zi ¯Œz wbqg a‡i cvIqv hvq|

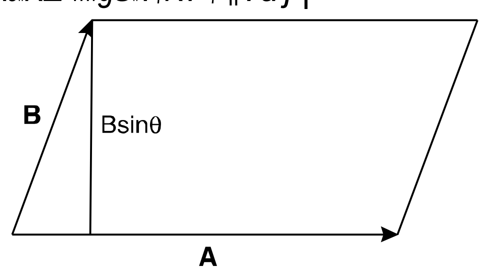
$$C = |\mathbf{A}\times\mathbf{B}| = AB\sin\theta$$

wKš‘ B sinθ n‡”Q **A** Ges **B** †K mwbœwnZ evû a‡i AswKZ mvgvš—wi‡Ki D”PZv|

∴ AB sinθ n‡”Q **A** Ges **B** †K mwbœwnZ evû a‡i AswKZ mvgvš—wi‡Ki ‡¶Îdj|



wPÎ 1.37 (K)



wPÎ 1.37 (L)

1.5.4 †f±i K¨vjKzjvm t †f±i e¨eKjb

AwZ ¶z`ª iwk we‡kølY wbÁvb nj K¨vjKzjvm| GwU MwY‡Zi AwZ ¸i“Z¡c~Y© kvLv| c`v_©weÁv‡bi MwYwZK we‡kølY K¨vjKzjvm Acwinvh©| Avgiv K¨vjKzjvm m¤ú‡K GKwU mvaviY avibv †bB|

aiv hvK, Avgiv GKwU Mvox‡Z hvw”Q| MvoxwU MwZkxj| nVvr †KD ck Ki‡jb ÒMvoxwUi `"wZ KZ?Ó Ab¨ †KD D‡ËiwU Ki‡jb ev DËi w`‡jb ÔÔNÈvq 60 wK‡jvwgUviÕÕ| fve‡Qb GLv‡bB †Zv †kl, bv Zv bq| GKUzfvewe †Zv| GB †h ejv nj ÔÔNÈvq 60ÕÕ G K_vq wK eySvq †Mj? ck Kiv mgq `"wZ NÈvq 60 wK‡jvwgUvi ? bv DËi †`qvi mgq `"wZ 60 wK‡jvwgUvi bwK DËi †`qvi Av‡Mi 1 NÈvq MwoU 60 wK‡jvwgUvi G‡m‡Q| wKsev DËi †`qvi c‡ii 1 N›Uvq MwowU 60 wK‡jvwgUvi AwZµg Ki‡e? †ek Sv‡gjvq co‡jb †Zv ? GKUzfvey|

Avm‡j MwZkxj e¯‘i mgq `‡iZ bv P‡j, Zv n‡j KLbB Zvi mwVK `ªæZ ejv P‡j bv| cKZ.c‡¶ ev¯e Rxe‡b †`wL mKj MwZkxj e¯‘ cwZ gyn‡Z Zvi †eM A_ev `ªæZ cwieZb K‡i| Avgiv ZvB N›Uvq bq, †m‡K‡Û wnmve Kwi| `ªæZ D‡ল্লখ Kwi 1000 wgUvi/†m‡KÛ Zvn‡j cwZ †m‡K‡Ûi `ªæZi K_v ejv cwZ N›Uvq `ªæZ ejv †_‡K mwVK bq wK? wKšzcwZ †m‡K‡Ûi ¯‡j cwZ wgwj †m‡KÛ, gvB‡µv‡m‡KÛ A_ev Avil ¶ÏZi mg‡qi m‡½ `¢Z AwZµ‡gi nvi ej‡Z cvi‡j Zv Avil mwVK n‡Zv| Gfv‡e ¶ÏZg mg‡q AwZµvš `¢Z‡K `ªæZ cwigvc wnmv‡e MnYB K¨vjKzjv‡mi gj aviYv| hv weÁv‡bi m¶ cwigv‡c AZ¨š ¸iZcY †Zv e‡UB AvKlYxq I|

aiv hvK, GKwU KYv t, †m‡K‡Û s GKK `¢Z AwZµg Ki‡Q| KYwU myg †e‡M P‡Q bv| GwU MwZkxj _vK‡j cwZ t †m‡K‡Û s Gi GKwU K‡i bZb gvb _vK‡e (A_vr s -Gi gvb cwieZZ n‡e)| G¶‡Î Avgiv ewj s ,t Gi GKwU dvskb ev A‡c¶K|

hw` ¶Ï mgq $\Delta t$Gi Rb¨ AwZµvš `¢Z Δs nq Zvn‡j H ¶Ï mg‡q †eM n‡e $\frac{\Delta s}{\Delta t}$ [Δt cov nq †Wj t, Δs cov nq †Wj s] $\Delta t, \Delta s$ cZxK †Wj Ges t ev †Wj Ges s Gi ¸Yb bq|

Δt hw` ¶ÏZg nq Zv n‡e k‡b¨i KvQvKwQ (k‡b¨i mgvb bq) ZLb K¨vjKzjv‡mi AwZ ¶Ï iwk welqK wnmv‡e G‡K Avgiv ‡hfv‡e wjwL Zv wbgiƒc|

†eM $\mathbf{v} = \lim_{\Delta t \to 0} \frac{\Delta \mathbf{s}}{\Delta t}$

A_vr $\mathbf{v} = \frac{d\mathbf{s}}{dt}$

GZ¶Y Avgiv mgq Ges `¢Z GB `yU iwk wb‡q D`vniY Dc¯vcb K‡iwQ| mvaviY †¶‡Î aiv nq x Ges y `yU PjK †hLv‡b x Gi A‡c¶K y| Zvn‡j x Gi mv‡c‡¶ y Gi ¶Ï cwieZ‡bi nvi n‡e,

$$\lim_{\Delta x \to 0} \frac{\Delta y}{\Delta x} \text{ ev } \frac{dy}{dx}$$

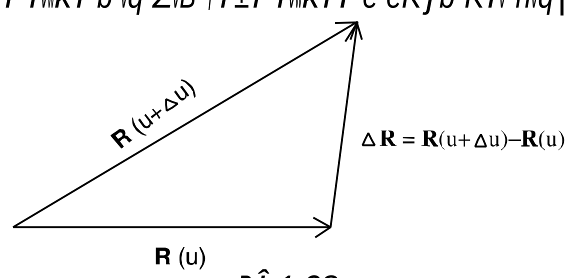
GwU nj x Gi mv‡c‡¶ y Gi e¨Ë×i nvi Ges GB cwµqvB nj e¨eKjb|

[†f±i exRMwYZ‡Z G m¤ú‡K Avil we¯wiZ Av‡jvPbv †`Lyb]|

GKwU †f±i iwk Ab¨ †¯‹jvi iwki Dci wbfi Ki‡Z cv‡i| †hgb MwZkxj e¯‘i Ae¯vb †f±i **r** mgq t Gi Dci wbfi K‡i| A_vr Ae¯vb †f±i **r** mgq t Gi dvskb ev A‡c¶K| †Zgwb myg Zi‡Y MwZkxj e¯‘i †eM **v** mgq t Gi A‡c¶K| †Kvb Zwor Avavb KZK.mƒó Zwor †¶‡Îi †Kvb we›`y cvej¨ Avavb †_‡K we›`yi `¢‡Zi Dci wbfi K‡i| mvaviY †¯‹jvi iwki b¨vq ZvB †f±i iwkil e¨eKjb Kiv hvq|

aiv hvK †f±i iwk **R** ‡¯‹jvi iwk u Gi A‡c¶K ev **R**(u)| Zvn‡j -

$$\frac{\Delta \mathbf{R}}{\Delta u} = \frac{\mathbf{R}(u+\Delta u) - \mathbf{R}(u)}{\Delta u}$$



wPÎ 1.38

GLv‡b Δu nj u Gi e¨× Ges $\Delta \mathbf{R}$ nj **R** Gi e¨× (wPÎ 1.38)| Zvn‡j u Gi mv‡c‡¶ **R** Gi e¨×i nvi n‡e,

$$\frac{d\mathbf{R}}{du} = \lim_{\Delta u \to 0} \frac{\Delta \mathbf{R}}{\Delta u} = \lim_{\Delta u \to 0} \frac{\mathbf{R}(u+\Delta u)-\mathbf{R}(u)}{\Delta u}$$

D`vniY¯^iƒc aiv hvK $\mathbf{r}$(t) n‡"Q ¯’vbvsK e¨e¯’vi g~j we›`y O Ges †h †Kvb GKwU we›`y (x, y, z) Gi ms‡hvMKvix Ae¯’vb †f±i (wPÎ 1.39) Zvn‡j,

$$\mathbf{r}(t) = x(t)\hat{i} + y(t)\hat{j} + z(t)\hat{k}$$

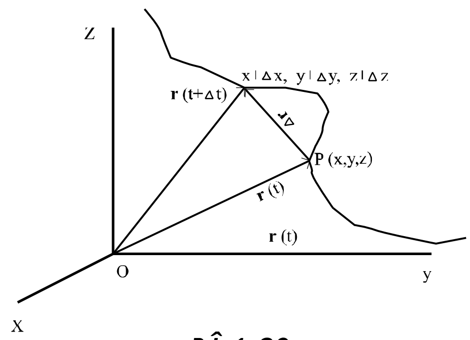
mgq t Gi cwieZ©‡bi mv‡_ $\mathbf{r}$ Gi kx‡l©i we›`y GKwU eµ‡iLv eYbv K‡i| Zvn‡j,

$$\frac{\Delta \mathbf{r}}{\Delta t} = \frac{\mathbf{r}(t+\Delta t)-\mathbf{r}(t)}{\Delta t}$$

$\Delta\mathbf{r}$ Gi AwfgyL GKwU †f±i wb‡`©k K‡i (wPÎ 1.38)

mxgvi‡_© $\lim_{\Delta t \to 0} \frac{\Delta \mathbf{r}}{\Delta t} = \frac{d\mathbf{r}}{dt}$ n‡"Q GKwU †f±i

$$\frac{d\mathbf{r}}{dt} = \frac{dx}{dt}\hat{i} + \frac{dy}{dt}\hat{j} + \frac{dz}{dt}\hat{k}$$



wPÎ 1.39

hvi AwfgyL n‡"Q (x, y, z) we›`y‡Z eµ‡iLvi mv‡_ Aw¯Z¯úkK ei¦ei| GLv‡b $\mathbf{r}$ Gi cvš— we›`y‡h †eM wb‡q eµ †iLwU ^ZwM K‡i‡Q $\frac{d\mathbf{r}}{dt}$ †mB †eM $\mathbf{v}$ wb‡`©k K‡i|

mgq t Gi mv‡c‡¶ $\mathbf{r}$ ‡K e¨eKjb Ki‡j †eM $\mathbf{v}$ cvIqv hvq, Zv Avgiv MwZi mgxKiY †_‡K I †c‡Z cwi| MwZi mgxKiY nj

$$\mathbf{r} = \mathbf{v}_0 t + \frac{1}{2}\mathbf{a}t^2$$

GLv‡b $\mathbf{r}$ miY, $\mathbf{v}_0$ Avw`‡eM, Ges $\mathbf{a}$ ZiY| GB mgxKiY‡K t Gi mv‡c‡¶ e¨eKjb K‡i Avgiv cvB,

$$\frac{dr}{dt} = \mathbf{v}_0\frac{dt}{dt} + \frac{1}{2}\mathbf{a}\frac{d(t^2)}{dt}$$

ev, $\frac{d\mathbf{r}}{dt} = \mathbf{v}_0 + \mathbf{at}$

wKš' MwZi Aci mgxKiY †_‡K Avgiv Rvwb $\mathbf{v} = \mathbf{v}_0 t + \mathbf{a}t$ GB `yB mgxKiY Zzjbv K‡i cvB

$$\frac{d\mathbf{r}}{dt} = \mathbf{v}$$

e¨eKj‡bi mvaviY m~Î¸‡jv †f±i iwki e¨eKj‡bi Rb¨I cÖ‡hvR¨| Z‡e j¶¨ ivL‡Z n‡e †f±i iwki Ae¯'v‡bi µg hv‡Z eRvq _v‡K| cieZx© Aa¨v‡q †f±i e¨eKjb m¤ú‡K© Avil Rvb‡ev| exRMwYZ I K¨vjKzjvm Aa¨q‡b I e¨eKjb m¤ú‡K© aviYv Avil ¯úó n‡e|

cv‡VÖi gj¨vqb

mwVK DËiwU‡Z wUK wPý (√) w`b|

1| m GKwU †¯‹jvi ivwk w`‡q **B** ‡K ¸Y Kiv nj GwUi †f±i dj wK n‡e?

K. mB

L. mB

M. m**B**

N. $\left|\vec{m\ B}\right|$

2| `yBwU †f±i ivwk ¸Y‡bi d‡j hLb GKwU †¯‹jvi ivwk cvIqv hvq ZLb G‡K †Kvb ¸Yb e‡j

K. †f±i ¸Yb

L. WU ¸Yb

M. µm ¸Yb

N. †f±i †f±i ¸Yb

3| **A** I **B** `yBwU †f±i ivwki ga¨eZx †KvY θ n‡j Zv‡`i †f±i ¸Ydj KZ n‡e?

K. $\mathbf{A} \times \mathbf{B}\sin\theta$

L. $\mathbf{n}\ AB\sin\theta$

M. $AB\sin\theta$

N. $\mathbf{n}\ AB\sin\theta$

4| **A** I **B** `yBwU †f±i ivwki ga¨eZx †KvY θ n‡j Zv‡`i ‡¯‹jvi ¸Ydj KZ n‡e?

K. $\mathbf{A}.\ \mathbf{B}$

L. $\mathbf{A}.\ \mathbf{B}\cos\theta$

M. $|A.\ A|\cos\theta$

N. $AB\cos\theta$

5| $\mathbf{r} = \mathbf{v_0}\, t + \frac{1}{2}\, \mathbf{a}\, t^2$ mgxKi‡Y r(t) mgxKiYwU‡K t Gi mv‡c‡¶ e¨eKjb Ki‡j wK cve?

K. $\frac{d\mathbf{r}}{dt} = \mathbf{v}_0 + \mathbf{at}$

L. $\frac{\Delta r}{\Delta t} = \mathbf{v}_0\ \mathbf{at}$

M. $r = \mathbf{v}_0\, t + \frac{1}{2}\, \mathbf{at}^2$

N. $\frac{\Delta \mathbf{r}}{\Delta t} \underset{\Delta t \to 0}{Lt} = \frac{d\mathbf{v}}{dt}$

PZz_© gwWDj
mwVK DËiwU‡Z wUK wPý (√) w`b|

1| c‡Z¨K †f±i ivwki wZbwU ^ewkó¨ nj -
K. ˆ`N©¨, avivK †iLv Ges w`K — L. gvb, w`K I ˆ`N©¨
M. Awf` we›`y ˆ`N©¨, gvb — N. Awf` we›`y†kl we›`y I gvb

2| `ywU mgRvZxq †f±‡ii w`K GKB, Zv‡`i aviK †iLv GKB n‡j Zv‡`i wK e‡j?
K. mgvb †f±i — L. m`„k †f±i
M. mgvšÍivj †f±i — N. wecixZ †f±i

3| †Kvb †f±i R ‡K hw` `ywU ci¯úi j¤ Dcvs‡k wefwRZ Kiv nq Zvn‡j RGi mv‡_ α †Kv‡Yi Dcvsk KZ n‡e ?
K. $R \sin\alpha$ — L. $R \cos\alpha$
M. $X \cos\alpha$ — N. $X \sin\alpha$

4| abvZK Z A¶ eivei GKK †f±i †KvbwU?
K. $\mathbf{i}$ — L. $\mathbf{j}$
M. $\mathbf{k}$ — N. $\mathbf{n}$

5| cm½ KvVv‡gvi gj¨ we›`y mv‡c‡¶ †Kvb we›`y Ae¯vb‡K †h ivwk Øviv cKvk Kiv nq Zv‡K wK e‡j?
K. Ae¯vb ivwk — L. gj¨ †f±i
M. Ae¯vb †f±i — N. cvmw½K †f±i

6| $r = v_0 t + \frac{1}{2} at^2$ n‡j $\frac{d\mathbf{r}}{dt}$ Gi gvb KZ n‡e?
K. $v_0 + \frac{1}{2} at$ — L. $v_0 + at$
M. $v_0 t + \frac{1}{2} a$ — N. $\frac{1}{2} at^2$

7| `ywU †f±i ivwk $\hat{a}, \hat{b}$ Gi ga¨eZx †KvY $\theta$ n‡j Zv‡`i †¯‹jvi ¸Ydj KZ? hLb $(\theta \le \pi)$
K. $\hat{a}, \hat{b} \cos\theta$ — L. $ab \cos\theta$
M. $ab \sin\theta$ — N. $|\hat{a}|\,|\hat{b}| \sin\theta$

8| **A, B** `ywU †f±‡ii ga¨eZx †KvY θ (hLb $0 < \theta < \pi$) n‡j,
K. $|\mathbf{A} \times \mathbf{B}| = AB \cos\theta$ — L. $|\mathbf{A} \times \mathbf{B}| = AB \sin\theta$
M. $|\mathbf{A} \times \mathbf{B}| = AB$ — N. $|\mathbf{A} \times \mathbf{B}| = |\mathbf{A} \times \mathbf{B}| \cos\theta$

9| †Kvb we›`yi Gi ¯vbvsK (x, y, z) n‡j e¨vmva© †f±i r Gi gvb KZ?
K. $\hat{r} = \hat{i}x + \hat{j}y + \hat{k}z$ — L. $r = x + y + z$
M. $r = x^2 + y^2 + z^2$ — N. $r = \sqrt{x^2 + y^2 + z^2}$

msw¶ß DËi ck

1| †f±i iwwki msÁvmn D`vniY w`b|
2| †¯‹jvi iwwki msÁvmn D`vniY w`b|
3| wb‡Pi iwwk¸‡jvi g‡a¨ †Kvb¸wj †f±i Avi †Kvb¸wj †¯‹jvi ejyb: miY, fi, IRb, ˆ`N¨, `"wZ, †eM, KvR, mgq, kw³, Zwor cvej¨|
4| msÁv w`b : gy³ †f±i, e× †f±i, mgvb †f±i, kb¨ †f±i, Ae¯'vb †f±i|
5| GKK †f±i ej‡Z wK eySv‡bv nq?
6| †f±i iwwk‡K R¨wgwZK Dcv‡q wKfv‡e wb‡`k Kiv hvq wPÎ mn e¨vL¨v Ki"b|
7| †f±i-†hv‡Mi wÎfyR m~wU eYbv Ki"b|
8| †f±i-†hv‡Mi eûfyR m~wU eYbv Ki"b|
9| AvqZ GKK †f±i Kv‡K e‡j? wPÎ mn e¨vL¨v Ki"b|
10| `yB †f±‡ii †¯‹jvi ¸Yb KLb nq?
11| †f±i iwwki †¯‹jvi ¸Ydj Kv‡K e‡j?
12| `yB †f±‡ii †f±i ¸Yb KLb nq?
13| †f±i iwwki ‡f±i ¸Ydj Kv‡K e‡j|
14| †f±‡ii †hvM †hv‡Mi wewbgq m~Î †g‡b P‡j wK?
15| †f±i we‡qvM †hv‡Mi ms‡hvM m~Î †g‡b P‡j wK?

wek` DËi ck

1| †f±i I †¯‹jvi iwwk Kv‡K e‡j Zv D`vniYmn e¨vL¨v Ki"b|
2| †f±i iwwki †hv‡Mi wbqg e¨vL¨v Ki"b|
3| †`Lvb †h †f±i iwwki †hvM wewbgq I ms‡hvM m~Î †g‡b P‡j|
4| †f±i †hv‡Mi mvgšÍwiK wewawU eYbv I jwä †f±i wbY‡qi MwYwZK m~wU cwZwôZ Ki"b|
5| R¨wgwZK wPÎ mn‡hv‡M cgvY Ki"b GKwU †f±‡ii mv‡_ Ab¨ †f±‡ii we‡qv‡Mi A_B nj GKwU †f±‡ii mv‡_ Ab¨ †f±iwUi FYvZK †f±‡ii †hvM|
6| kY¨ †f±i e¨vL¨v Ki"b|
7| †f±i wefvRb ej‡Z wK eySvq? †Kvb GKwU †f±i iwwk‡K `yB wbw`ó Dcvs‡k wefvR‡bi cwµqv eYbv Ki"b|
8| j¤ Dcvsk wK? R †f±‡ii j¤ Dcvsk¸wj wbi|cY Ki"b|
9| ˆ`bw›`b Rxe‡b †f±i wefvR‡bi `yB NUbv D‡jøL Ki"b
10| ˆ`bw›`b Rxe‡b †f±i ‡hvR‡bi `yB NUbv D‡jøL Ki"b|
11| wPÎ mn `yB †f±‡i †¯‹jvi ¸Yb e¨vL¨v Ki"b|
12| wPÎmn `yB †f±‡ii †f±i ¸Yb e¨vL¨v Ki"b|
13| †f±i ¸Ydj I †¯‹jvi ¸Yd‡ji g‡a¨ cv_K¨ wb‡`k Ki"b|
14| †f±i iwwki e¨eKjb ej‡Z wK eySvq Zv e¨vL¨v Ki"b|