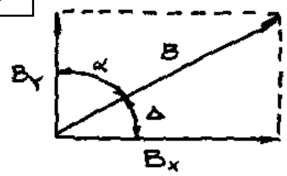
4.1



GIVEN: $B_x = 7.2\,m$, $\Delta = 35°$

FIND: α, B_Y, B

SOLUTION:

$\alpha = 90° - 35° = \underline{\underline{55°}}$

$\tan \Delta = \dfrac{B_Y}{B_x}$

$B_Y = B_x \tan \Delta$

$= (7.2\,m)(\tan 35°)$

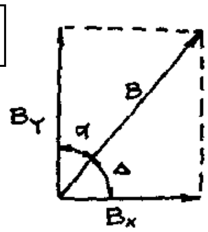
$= 5.04 \cong \underline{\underline{5.0\,m}}$

$\cos \Delta = \dfrac{B_Y}{B}$

$B = \dfrac{B_x}{\cos \Delta} = \dfrac{7.2\,m}{\cos 35°}$

$= 8.79 \cong \underline{\underline{8.8\,m}}$

4.2



GIVEN: $\alpha = 51°$, $B_Y = 4.9\,km$

FIND: Δ, B_x, B

SOLUTION:

$\Delta = 90° - 51° = \underline{\underline{39°}}$

$\tan \Delta = \dfrac{B_Y}{B_x}$

$B_x = \dfrac{B_Y}{\tan \Delta} = \dfrac{4.9\,km}{\tan 39°}$

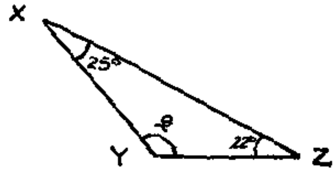
$= 6.051 \cong \underline{\underline{6.1\,km}}$

$\cos \Delta = \dfrac{B_x}{B}$

$B = \dfrac{B_x}{\cos \Delta} = \dfrac{6.051}{\cos 39°}$

$= 7.79 \cong 7.8\,km$

4.3



GIVEN: $YZ = 1.0 \times 10^6\,m$

FIND: XZ

SOLUTION:

$\beta = 180° - 25° - 22° = 133°$

LAW OF SINES

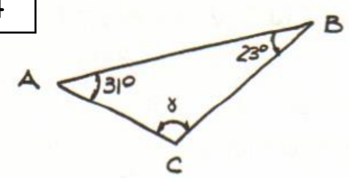
$\dfrac{XZ}{\sin \beta} = \dfrac{YZ}{\sin 25°}$

$XZ = \dfrac{YZ(\sin \beta)}{\sin 25°}$

$= \dfrac{(1.0 \times 10^6\,m)(\sin 133°)}{\sin 25°}$

$= \underline{\underline{1.7 \times 10^6\,m}}$

4.4



GIVEN: $AC = 3.6 \times 10^3$ m

FIND: AB

SOLUTION:

$\gamma = 180° - 31° - 23° = 126°$

LAW OF SINES

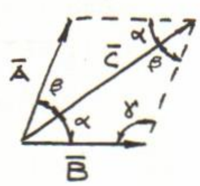
$$\frac{AB}{\sin\gamma} = \frac{AC}{\sin 23°}$$

$$AB = \frac{AC(\sin\gamma)}{\sin 23°}$$

$$= \frac{(3.6 \times 10^3 m)(\sin 126°)}{\sin 23°}$$

$$= \underline{\underline{7.5 \times 10^3 m}}$$

4.5



GIVEN: $\bar{B}$ IS HORIZONTAL

$\alpha = 31°$, $\beta = 22°$, $|\bar{B}| = 29m$

FIND: $|\bar{A}|$, $|\bar{C}|$

SOLUTION:

LAW OF SINES

$\gamma = 180° - \alpha - \beta$

$= 180° - 31° - 22° = 127°$

$$\frac{|\bar{C}|}{\sin\gamma} = \frac{|\bar{B}|}{\sin\beta}$$

$$|\bar{C}| = \frac{|\bar{B}|\sin\gamma}{\sin\beta} = \frac{(29m)(\sin 127°)}{\sin 22°}$$

$= 61.83$

AND

$$\frac{|\bar{A}|}{\sin\alpha} = \frac{|\bar{B}|}{\sin\beta}$$

$$|\bar{A}| = \frac{|\bar{B}|\sin\alpha}{\sin\beta}$$

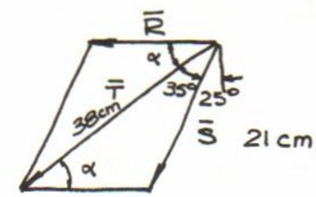
$$= \frac{(29m)(\sin 31°)}{\sin 22°}$$

$= 39.87$

$\bar{A} = 40m \angle 53°$

$\bar{C} = 62m \angle 31°$

4.6



FIND: $\bar{R}$

SOLUTION:

LAW OF COSINES

$|\bar{R}|^2 = |\bar{S}|^2 + |\bar{T}|^2 - 2|S||T|\cos 35°$

$|\bar{R}|^2 = (21)^2 + (38)^2 - (2)(21)(38)\cos 35°$

$|\bar{R}|^2 = 577.63$

$|\bar{R}| = 24.03$

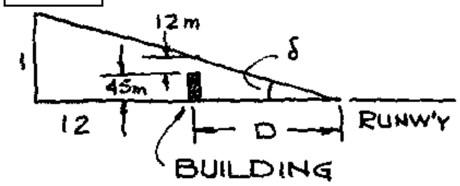
LAW OF SINES

$$\frac{\sin\alpha}{21} = \frac{\sin 35°}{24.03}$$

$$\alpha = \sin^{-1}\left[\frac{(21)\sin 35°}{24.03}\right] = 30.0°$$

$\bar{R} = \underline{\underline{24 \text{ cm} \longleftarrow \text{HORIZONTAL}}}$

4.7

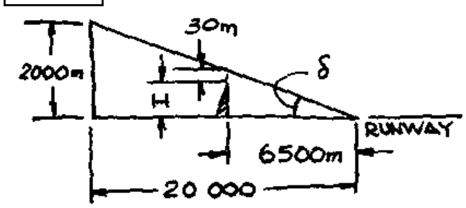


$$\tan \delta = \frac{1}{12} = \frac{(45+12)\,m}{D}$$

$$D = 12\,(45+12) = 684$$

$$\cong \underline{\underline{6.8 \times 10^2\,m}}$$

4.8

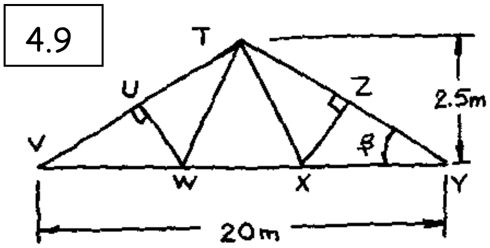


$$\tan \delta = \frac{2\,000}{20\,000} = \frac{H+30}{6500}$$

$$H = \left(\frac{2\,000}{20\,000}\right)(6500) - 30$$

$$= \underline{\underline{6.2 \times 10^2\,m}}$$

4.9



GIVEN: VW = WX = XY

VY ≅ 20 m

FIND: XT, XZ

SOLUTION:

$$\tan \beta = \frac{2.5}{10}$$

$$\beta = \tan^{-1}\left(\frac{2.5}{10}\right) = 14.04^\circ$$

$$\sin \beta = \frac{XZ}{XY} = \frac{XZ}{20/3}$$

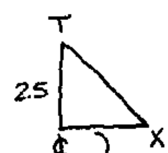
$$XZ = \left(\frac{20}{3}\right) \sin 14.04^\circ$$

$$= 1.62\,m \cong \underline{\underline{1.6\,m}}$$

$$XT = \sqrt{(\text{HEIGHT})^2 + (\text{BASE})^2}$$

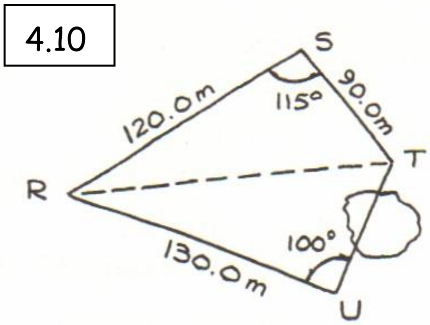
$$= \sqrt{(2.5)^2 + \left(\frac{20}{6}\right)^2}$$

$$= \underline{\underline{4.2\,m}}$$



$$\left(\frac{20}{3}\right)\left(\frac{1}{2}\right)$$

4.10



FIND: UT & AREA OF PLOT

SOLUTION:

LAW OF COSINES

$$RT^2 = (RS)^2 + (ST)^2 - (2)(ST)(RS)\cos(RST)$$

$$= (120)^2 + (90)^2 - (2)(120)(90)\cos 115°$$

$$RT = 177.84 \text{ m}$$

$$RT^2 = (RU)^2 + (UT)^2 - (2)(RU)(UT)\cos(RUT)$$

$$= (130)^2 + (UT)^2 - (2)(130)(UT)\cos 100°$$

$$= 177.84$$

$$(UT)^2 + 45.15(UT) - 16\,722 = 0$$

$$UT = \frac{-45.15 \pm \sqrt{(45.15)^2 - (4)(-16722)}}{2}$$

$$= \frac{-45.15 \pm 262.54}{2}$$

$$= -153.85,\ 108.70$$

$$\therefore\ UT = \underline{\underline{109 \text{ m}}}$$

AREA FORMULA:

$$\text{AREA} = \frac{1}{2}(A)(B)\ \text{SIN}$$

FOR RST:

$$\text{AREA} = \left(\tfrac{1}{2}\right)(120)(90)\ \text{SIN}$$

$$= 4894.06 \text{ m}^2$$

FOR RUT:

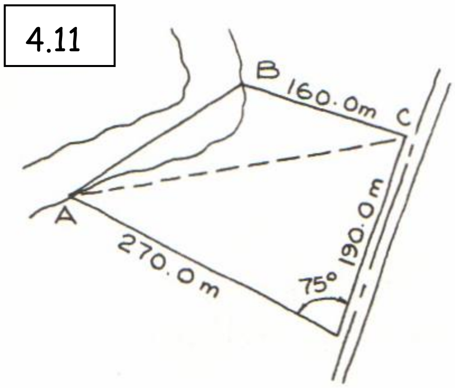
$$\text{AREA} = \left(\tfrac{1}{2}\right)(130)(108.70)\ \text{SI}$$

$$= 6958.16 \text{ m}^2$$

$$\text{TOTAL AREA} = 11\,852$$

$$\cong \underline{\underline{1.19 \times 10^4 \text{ m}^2}}$$

4.11



FIND:

AB & ∠ABC

SOLUTION:

LAW OF COSINES

$$AC^2 = (AD)^2 + (CD)^2 - 2(AD)(CD)\cos(ADC)$$

$$= (270)^2 + (190)^2 - 2(270)(190)\cos 75°$$

$$AC = 287.13 \text{ m}$$

FROM THE LAW OF SINES:

$$\frac{\sin \angle ACD}{270} = \frac{\sin 75°}{287.13}$$

$$\angle ACD = \sin^{-1}\left[\left(\frac{270}{287.13}\right)\sin 75°\right]$$

$$= 65.2714°$$

THEN

$$\angle BCA = 90° - 65.2714°$$

$$= 24.7286°$$

AGAIN FROM THE LAW OF COSINES:

$$(AB)^2 = (AC)^2 + (BC)^2 - 2(AC)(BC)\cos(BCA)$$

$$= (287.13)^2 + (160)^2 - 2(287.13)(160)\cos 24.7286°$$

$$AB = 156.80\text{m} \cong \underline{\underline{156.8\text{ m}}}$$

FROM LAW OF SINES:

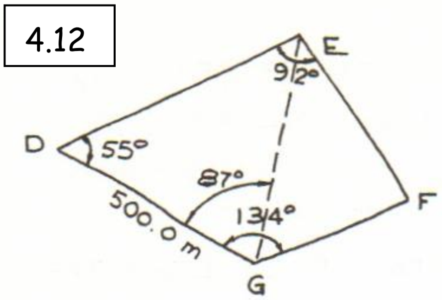
$$\frac{\sin ABC}{AC} = \frac{\sin BCA}{AB}$$

$$\angle ABC = \sin^{-1}\left[\frac{AC}{AB}\sin BCA\right]$$

$$= \sin^{-1}\left[\frac{287.13}{156.80}\sin 24.7286°\right]$$

$$= \underline{\underline{130.0°}}$$

4.12



FIND: DE, EF, FG, EG

SOLUTION:

$\angle DEG = 180° - 55° - 87° = 38°$

FROM LAW OF SINES:

$$\frac{\sin 38°}{500.0} = \frac{\sin 87°}{DE}$$

$$DE = (500)\frac{\sin 87°}{\sin 38°}$$

$$= 811.022 \text{ m}$$

$$\frac{\sin 38°}{500.0} = \frac{\sin 55°}{EG}$$

$$EG = (500.0)\frac{\sin 55°}{\sin 38°}$$

$$= 665.262 \text{ m}$$

$\angle GEF = 92° - 38° = 54°$

$\angle EGF = 134° - 87° = 47°$

THEN $\angle GFE = 180° - 54° - 47°$

$\angle GFE = 79°$

FROM THE LAW OF SINES

$$\frac{\sin 54°}{FG} = \frac{\sin 79°}{665.262}$$

$$FG = (665.262)\frac{\sin 54°}{\sin 79°}$$

$$= 548.28 \text{ m}$$

$$\frac{\sin 47°}{EF} = \frac{\sin 79°}{665.262}$$

$$EF = (665.262)\left(\frac{\sin 47°}{\sin 79°}\right)$$

$$= 495.65 \text{ m}$$

RESULTS:

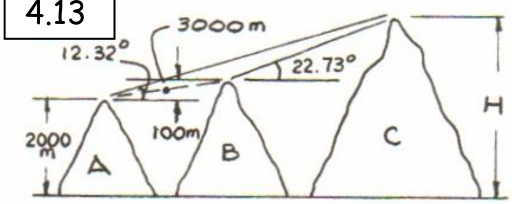
DE = 811.0 m

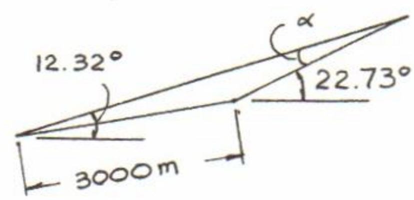
EF = 495.7 m

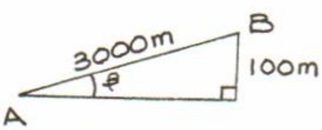
FG = 548.3 m

EG = 665.3 m

4.13







DETERMINE: H

$$\sin\beta = \frac{100}{3000}$$

$$\beta = \sin^{-1}\left[\frac{100}{3000}\right] = 1.910°$$

$$\alpha = 22.73° - 12.32° = 10.41°$$

$$\frac{\sin\alpha}{3000} = \frac{\sin(12.32 - 1.910)}{BC}$$

$$= \frac{\sin 10.41}{3000}$$

4.13 con't.

$$BC = \frac{3000 \sin(12.32 - 1.910)}{\sin 10.41}$$

$$= 3000\,m$$

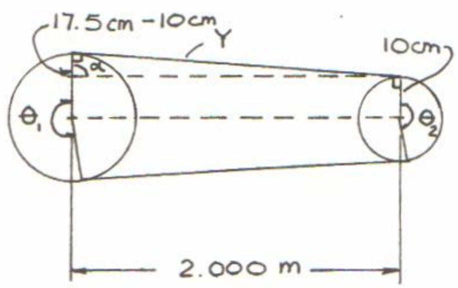
$$H = 2000 + 100 + BC \sin 22.73°$$

$$= 2000 + 100 + (3000)(\sin 22.73°)$$

$$= \underline{\underline{3259\,m}}$$

4.14

ROTATING SAME DIRECTION



$$\cos\alpha = \frac{7.5}{200} \Rightarrow \alpha = 87.85°$$

$$Y = 7.5 \tan 87.85° \cong 199.78\,cm$$

$$\theta_1 = \pi + \frac{2(90 - 87.85)\pi}{180} = 3.2166\text{ rad.}$$

$$\theta_2 = \pi - \frac{2(90 - 87.85)\pi}{180} = 3.1041\text{ rad.}$$

LENGTH OF BELT ON LARGE PULLEY

$$L_1 = R_1\theta_1 = (17.5)(3.2166)$$

$$= 56.2905\text{ cm}$$

LENGTH OF BELT ON SMALL PULLEY

$$L_2 = R_2\theta_2 = (10)(3.2166)$$

$$= 31.041\text{ cm}$$

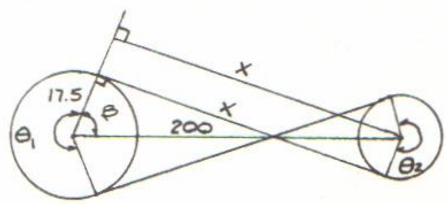
TOTAL BELT LENGTH =

$$L_1 + L_2 + 2Y =$$

$$56.2905 + 31.041 + 2(199.78)$$

$$\cong \underline{\underline{486.9\,cm}}$$

ROTATING OPPOSITE DIRECTIONS:



ASSUMPTION: NEGLECT CROSSOVER INTERFERENCE

$$\cos\beta = \frac{17.5 + 10}{200} \Rightarrow \beta = 82.10°$$

$$X = 27.5 \tan 82.10° \cong 198.18\,cm$$

LENGTH OF BELT ON LARGE PULLEY

$$L_1 = R_1\theta_1$$

$$= (17.5)\left[\pi + \frac{2(90 - 82.10)\pi}{180}\right]$$

$$= 59.804\text{ cm}$$

LENGTH OF BELT ON SMALL PULLEY

$$L_2 = R_2\theta_2$$

$$= (10)\left[\pi + \frac{2(90 - 82.10)\pi}{180}\right]$$

$$= 34.174\text{ cm}$$

4.10 con't.

TOTAL BELT LENGTH =

$L_1 + L_2 + 2X =$

$59.806 + 34.174 + 2(198.18) =$

$\underline{\underline{490.3 \text{ cm}}}$

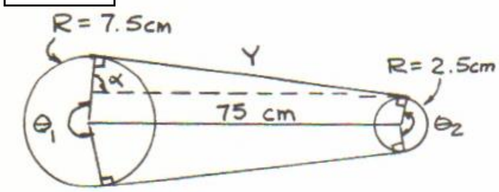
TOTAL CHAIN LENGTH

(NO SLACK) $= L_1 + L_2 + 2Y$

$= 24.56 + 7.52 + 2(74.88)$

$= \underline{\underline{1.8 \times 10^2 \text{ cm}}}$

4.15



$\cos\alpha = \dfrac{7.5 - 2.5}{75} = \dfrac{5.0}{75}$

$\Rightarrow \alpha = 86.18°$

$Y = 5.0 \tan 86.18° = 74.88 \text{ cm}$

$\theta_1 = \pi + \dfrac{2(90 - 86.18)\pi}{180}$

$\theta_2 = \pi - \dfrac{2(90 - 86.18)\pi}{180}$

LENGTH OF CHAIN ON LARGE SPROCKET

$L_1 = R_1\theta_1$

$= (7.5)\left[\pi + \dfrac{2(90-86.18)\pi}{180}\right]$

$= 24.56 \text{ cm}$

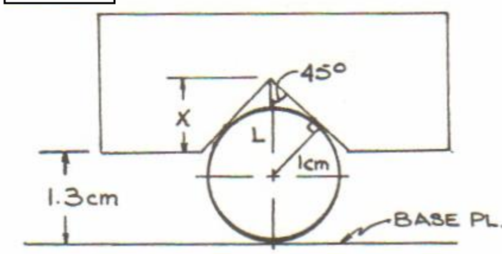
LENGTH OF CHAIN ON SMALL SPROCKET

$L_2 = R_2\theta_2$

$= (2.5)\left[\pi - \dfrac{2(90-86.18)\pi}{180}\right]$

$= 7.52 \text{ cm}$

4.16



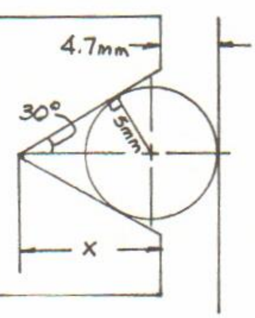
$\sin 45° = \dfrac{1 \text{ cm}}{L}$

$L = \dfrac{1 \text{ cm}}{\sin 45°} = 1.414 \text{ cm}$

$X + 1.3 \text{ cm} = L + 1 \text{ cm}$

$X = 1.414 + 1 - 1.3 = \underline{\underline{1.1 \text{ cm}}}$

4.17



$\sin 30° = \dfrac{5 \text{ mm}}{L}$

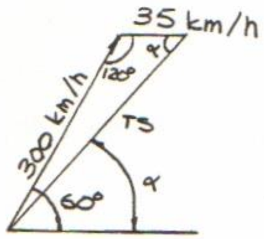
$L = \dfrac{5 \text{ mm}}{\sin 30°}$

$= 10.00 \text{ mm}$

$X + 4.7 \text{ mm} = L + 5 \text{ mm}$

$X = 10.00 + 5 - 4.7 = \underline{\underline{10.3 \text{ mm}}}$

4.18



LAW OF COSINES

$$(TS)^2 = (300)^2 + (35)^2 - (2)(300)(35)\cos 120^\circ$$

$$TS = 318.94 \text{ km/h}$$

LAW OF SINES

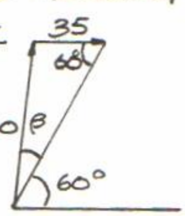
$$\frac{\sin\alpha}{300} = \frac{\sin 120^\circ}{318.94}$$

$$\alpha = \sin^{-1}\left[\frac{300}{318.94}\sin 120^\circ\right]$$

$$= 54.55^\circ$$

$$\overline{TS} = \underline{\underline{320 \text{ km/h} \quad N\,35^\circ E}}$$

FOR A TRUE HEADING OF N 30°E



LAW OF SINES

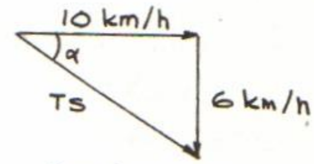
$$\frac{\sin 60^\circ}{300} = \frac{\sin\beta}{35}$$

$$\beta = \sin^{-1}\left[\frac{35}{300}\sin 60^\circ\right] = 5.8^\circ$$

$$(60^\circ + 5.8^\circ = 65.8^\circ)$$

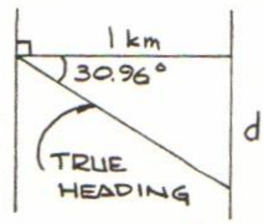
PILOT SHOULD FLY N24°E FOR A TRUE HEADING OF N30°E.

4.19



$$\tan\alpha = \frac{6 \text{ km/h}}{10 \text{ km/h}} = \frac{6}{10}$$

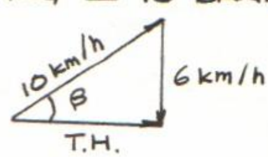
$$\alpha = \tan^{-1}\frac{6}{10} = 30.96^\circ$$



$$\tan 30.96^\circ = \frac{d}{1 \text{ km}}$$

$d = 1 \tan 30.96^\circ = 0.6$ km DOWN-STREAM

TO REACH OPPOSITE BANK DIRECTLY ACROSS FROM DOCK, MUST HAVE TRUE HEADING ⊥ TO BANK



$$\sin\beta = \frac{6}{10}$$

$$\beta = \sin^{-1}\frac{6}{10} = \underline{\underline{36.87^\circ}}$$

4.20

$$\text{SIN } \Delta = \frac{125}{600}$$

$$\Delta = \text{SIN}^{-1}\left[\frac{125}{600}\right] = 12.02^\circ$$

$$\text{TAN } \Delta = \frac{125}{GS}$$

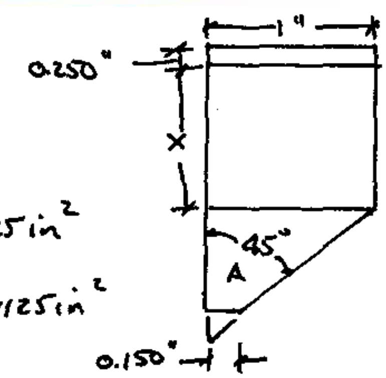
$$GS = \frac{125}{\text{TAN } 12.02^\circ} = 587.07 \text{ km/h}$$

HEADING MUST BE S12.0°W

TRUE GROUND SPEED = 587 km/h

4.21

WORST CASE 888 --



$$300 \text{ PINS/h } (3\text{h}) = 900 \text{ pins}$$

$$A_{900\text{ pins}} = (0.150)^2(900) = 20.25 \text{ in}^2$$

$$A_{\text{MISSING}} = \tfrac{1}{2}(0.150)(0.150) = 0.01125 \text{ in}^2$$

$$A_A = (\tfrac{1}{2})(1.000)(1.000) - 0.01125$$
$$= 0.48875 \text{ in}^2$$

$$(X)(1) + 0.48875 = 20.25$$
$$X = 19.761 \text{ in}$$

ADD 0.250"

$$\text{HEIGHT} = 19.761 + 0.250 \doteq 20''$$

4.22

MOUNTAIN:

(a) $C = \pi d = \pi(26) = 81.6814 \text{ in}$

$$\frac{480 \text{ mi}}{} \left| \frac{5280 \text{ ft}}{\text{mi}} \right| \frac{12 \text{ in}}{\text{ft}} = 3.04128 \times 10^7 \text{ in}$$

$$\text{REVOLUTIONS} = \frac{3.04128 \times 10^7}{81.6814} = 372\,334 \text{ rev}$$

TOURING:

$C = \pi(27) = 84.8230 \text{ in}$

$$\text{REVOLUTIONS} = \frac{3.04128 \times 10^7}{84.8230} = 358\,544 \text{ rev}$$

$$\text{DIFFERENCE} = 372\,334 - 358\,544 = \underline{\underline{13790 \text{ rev}}}$$

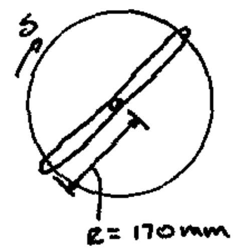
(b) 21 TEETH : 42 TEETH

1 REV : 2 REV

$$\left(\frac{13790}{2}\right)(0.85) = \underline{\underline{5861 \text{ REV}}}$$

(c) $170 \text{ mm} = 6.6929 \text{ in}$

$S = 2\pi r = 42.0528 \text{ in}$



MOUNTAIN:

$\text{REV OF CHAINWHEEL} = (0.5)(372334)(0.85)$

$= 158242 \text{ REV.}$

$\text{TOTAL PEDAL TRAVEL} = (158242)(42.0528) \text{ in}$

$= 105.027 \text{ mi}$

$$MA = \frac{480 \text{ mi}}{105.027 \text{ mi}} = \underline{\underline{457\%}}$$

TOURING:

$\text{REV OF CHAINWHEEL} = (0.5)(358544)(0.85) = 152381 \text{ REV}$

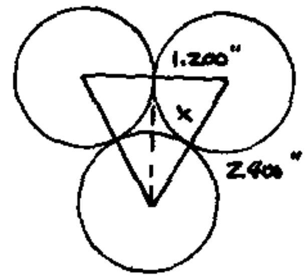
$\text{TOTAL PEDAL TRAVEL} = (152381)(42.0528) \text{ in}$

$= 101.137 \text{ mi}$

$$MA = \frac{480 \text{ mi}}{101.137 \text{ mi}} = \underline{\underline{475\%}}$$

4.23

$x = [(2.400)^2 - (1.200)^2]^{1/2} = 2.078 \text{ in}$



FOR CONFIGURATION SHOWN, 20 STAMPINGS/ft.

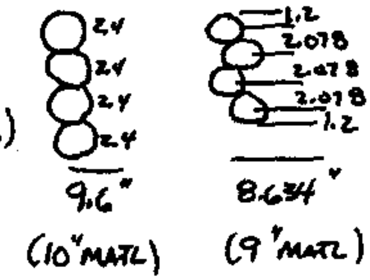
NEED $\frac{38000}{20} = 1900$ LINEAR FT.

WITH 1" NARROWER MAT'L

$(1900)(\frac{1}{12}) = 158.33 \text{ ft}^2$ SAVED

\$ SAVED $= (158.33 \text{ ft}^2)(3.20 \text{ lb/ft}^2)(\$0.20/\text{lb})$

$= \$101.33$

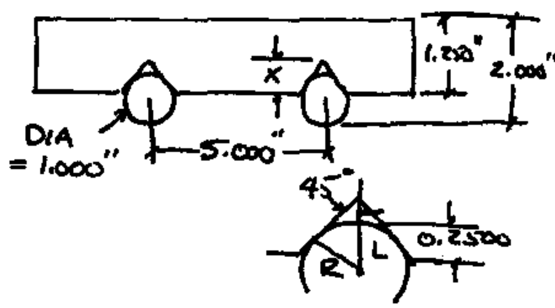


4.24

(a) $L = \frac{R}{\sin 45°} = \frac{0.5000}{\sin 45°} = 0.7071"$

DEPTH $= 0.7071 - 0.2500$

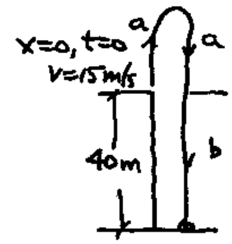
$= 0.4571"$ DEEP



(b) $h = 5 \sin 22.5° = 1.913"$

4.25

ASSUME NO AIR FRICTION



(a) $V = \underline{\underline{0 \, m/s}}$

(b) $V^2 = V_0^2 + 2a(x - x_0)$

$x = \dfrac{V^2 - V_0^2}{2a} + x_0$

$= \dfrac{0^2 - (15)^2}{2(-9.807)} + 0 = \underline{\underline{11.5m}}$

(c) $\underline{\underline{15 \, m/s \text{ DOWNWARD}}}$

(d) $V^2 = V_0^2 + 2a(x - X_0)$

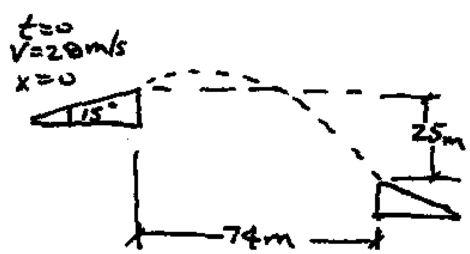
$V = \left[(15)^2 + 2(9.807)(40-0)\right]^{1/2}$

$= \underline{\underline{31.8 \, m/s}}$

(e) $V = V_0 + at$

$t = \dfrac{V - V_0}{a} = \dfrac{31.77 + 15}{9.807} = \underline{\underline{4.77s}}$

4.26



$V_y = (28)(\sin 15°) = 7.2469 \, m/s$

$V_x = (28)(\cos 15°) = 27.0459 \, m/s$

$V_y^2 = V_{y_0}^2 + 2a(y - y_0)$

$V_y = \left[(7.2469)^2 + (2)(-9.807)(-25-0)\right]^{1/2}$

$= 23.299 \, m/s \downarrow$

$V = V_0 + at$

$t = \dfrac{-23.299 - 7.2469}{-9.807} = 3.11s$

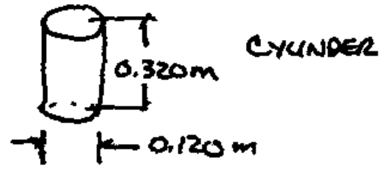
(a) $(3.11s)(27.05 m/s) = 84.125m$

$\underline{\underline{\text{YES WITH 10m TO SPARE}}}$

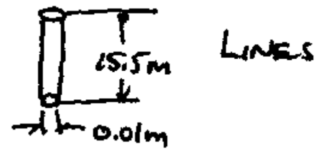
(b) $\underline{\underline{3.11s}}$

4.27

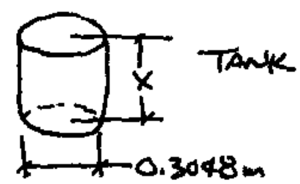
$$Vol_{CYL} = (\pi)\left(\frac{0.120}{2}\right)^2(0.320)$$
$$= 0.003619\ m^3$$
$$4\ Vol_{CYL} = 0.014476\ m^3$$



$$Vol_{LINES} = (\pi)\left(\frac{0.01}{2}\right)^2(15.5)$$
$$= 0.001217\ m^3$$



$$Vol_{TANK} = \pi\left(\frac{d}{2}\right)^2 x$$
$$x = \frac{(0.014476 + 0.001217)(4.5)}{\pi\left(\frac{0.3048}{2}\right)^2}$$
$$= 0.3226\ m$$
$$= \underline{\underline{32.26\ cm}}$$



4.28

$$\frac{50\ tons}{} \Bigg| \frac{2000\ lb}{Ton} \Bigg| \frac{2.2\ kg}{lb} = 2.20 \times 10^5\ kg \text{ COAL}$$

$$\text{ENERGY} = (2.20\times10^5)(6.2\times10^6) = 1.364\times10^{12}\ J$$

$$\varepsilon = \frac{W}{\text{ENERGY}} = \frac{545.6\times10^9\ J}{1.346\times10^{12}} = 0.40 \text{ or } \underline{\underline{40\%}}$$

4.29

$\rho_{COPPER} = 1.72 \times 10^{-8}\ \Omega \cdot m$ $\quad V = 110\,V$

$\rho_{AL} = 2.75 \times 10^{-8}\ \Omega \cdot m$ $\quad d = 0.005\,m$

$L = 10000\,m$

$V = IR\ ,\ R = \frac{\rho L}{A}$

$I = \frac{VA}{\rho L}\ ,\ A = \pi\left(\frac{d}{2}\right)^2$

$I = \frac{V\pi\left(\frac{d}{2}\right)^2}{\rho L}$

$I_{copper} = \frac{(110V)\pi\left(\frac{0.005}{2}\right)^2}{(1.72 \times 10^{-8})(10000)} = 12.56A$

$I_{AL} = \frac{(110V)\pi\left(\frac{0.005}{2}\right)^2}{(2.75 \times 10^{-8})(10000)} = 7.85A$

DIFFERENCE $= 12.56 - 7.85 = \underline{\underline{4.71A}}$

4.30

$n_a \sin\theta_a = n_b \sin\theta_b$

$(1)\sin 38° = n_b \sin 23°$

$n_b = \underline{\underline{1.58}}$