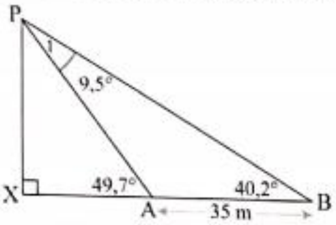
ANSWERS: GR 11 2D TRIG

Exercise 1 (page 173)

1. PA is the side common to △PAX and △PAB.



In △PAB:

$\hat{P}_1 = 9{,}5°$ (exterior angle of △PAB)

$\frac{PA}{\sin 40{,}2°} = \frac{35}{\sin 9{,}5°}$

$\therefore PA = \frac{35 \sin 40{,}2°}{\sin 9{,}5°}$

$= 136{,}9$ m

In △PAX:

$\sin 49{,}7° = \frac{PX}{136{,}9}$ (right-angled triangle)

$\therefore PX = 136{,}9 \sin 49{,}7°$

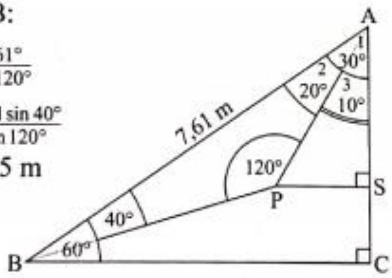
$= 104{,}4$ m

2. 2.1 In △PAB:

$\frac{AP}{\sin 40°} = \frac{7{,}61°}{\sin 120°}$

$\therefore AP = \frac{7{,}61 \sin 40°}{\sin 120°}$

$= 5{,}65$ m



2.2 $\hat{A}_1 = 30°$ (three angles of △ABC)

$\hat{A}_2 = 20°$ (three angles of △PAB)

$\therefore \hat{A}_3 = 10°$

In △PAS:

$\cos 10° = \frac{AS}{AP}$

$\therefore AS = AP \cos 10°$

$= 5{,}65 \cos 10°$

$= 5{,}56$ m

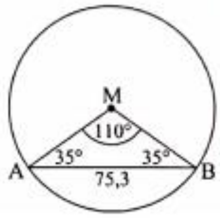
3.1 $\hat{A} = \hat{B}$ (In △AMB, AM = BM, radii)

$= 35°$ (interior angles of △AMB)

$\frac{AM}{\sin 35°} = \frac{75{,}3}{\sin 110°}$

$\therefore AM = \frac{75{,}3 \sin 35°}{\sin 110°}$

$= 45{,}96$ m

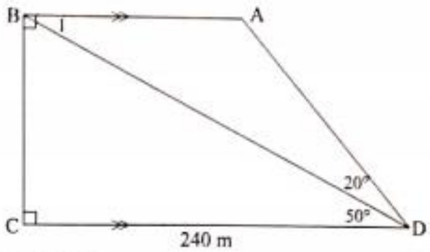


3.2 Area $\triangle AMB = \frac{1}{2} \cdot AM \cdot MB \cdot \sin A\hat{M}B$

$= 12(45{,}96)^2 \sin 110°$

$= 992{,}47 \text{ m}^2$

4.



In △BCD:

$\cos 50° = \frac{240}{BD}$

$\therefore BD = \frac{240}{\cos 50°}$

$= 373{,}4$

In △BAD:

$\hat{B}_1 = 50°$ (AB ∥ CD; alternate angles)

$\hat{A} = 110°$

$\therefore \frac{AD}{\sin 50°} = \frac{373{,}4}{\sin 110°}$

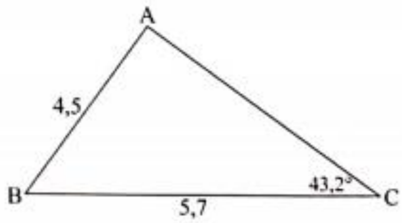
$\therefore AD = 304{,}4$

$\therefore$ Area $\triangle ABD = \frac{1}{2}$ BD . AD sin 20°

$= \frac{1}{2} 304{,}4 \times 373{,}4 \sin 20°$

$= 19\ 437{,}4 \text{ m}^2$

5.



5.1 $\frac{\sin A}{5{,}7} = \frac{\sin 43{,}2°}{4{,}5}$

$\therefore \sin A = \frac{5{,}7 \sin 43{,}2°}{4{,}5}$

$\therefore \hat{A} = 60{,}1°$ or $119{,}9°$

(Â is opposite the longer side, therefore an acute or an obtuse angle)

5.2 $\hat{B} = 76{,}7°$ or $16{,}9°$

$\frac{AC}{\sin 76{,}7°} = \frac{4{,}5}{\sin 43{,}2°}$ or $\frac{AC}{\sin 16{,}9°} = \frac{4{,}5}{\sin 43{,}2°}$

$AC^2 = 50^2 + 60^2\ 2(50)(60) \cos 60°$

$= 3\ 100$

$\therefore AC = 56$ m

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6.1 $DC^2 = 7^2 + 4^2 - 2 \, . \, 7 \, . \, 4 \, . \cos 80°$ (cos rule)

$= 49 + 16 - 56 \, . \cos 80°$

$= 55{,}275\ldots$

$DC = 7{,}43$ mm

6.2 Area $\triangle BCD = \frac{1}{2} \times 7 \times 4 \times \sin 80° = 13{,}79 \text{ mm}^2$

6.3 $A\hat{B}C = 130°$ (Angles subtended by chord DA)

6.4 $A\hat{D}C = 50°$ (Opposite angles of cyclic quadrilateral supplementary)

$\frac{\sin 80°}{7{,}43} = \frac{\sin 50°}{DA}$

$\therefore DA = \frac{7{,}43 \times \sin 50°}{\sin 80°}$

$\therefore DA = 5{,}78$ mm

7.1 $PR^2 = PQ^2 \div QR^2 - 2 \, . \, PQ \, . \, QR \, . \cos Q$

$8^2 = 4^2 + 6^2 - 2 \, . \, 4 \, . \, 6 \, . \cos Q$

$48 \cos Q = 16 + 36 - 64 = -12$

$\cos Q = -\frac{12}{48} = -0{,}25$

$\therefore \hat{Q} = 104{,}5°$

7.2 $\hat{S} = 180° - 104{,}5°$ ($\hat{Q} + \hat{S} = 180°$, PQRS cyclic quad)

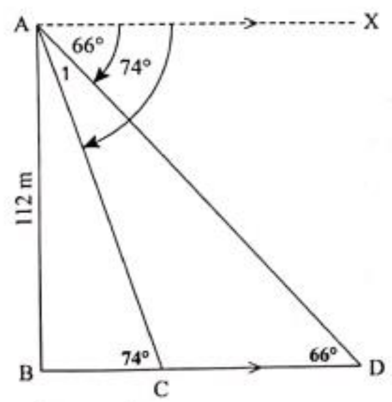
$= 75{,}5°$

7.3 $S\hat{P}R = 180° - 133{,}4° = 46{,}6°$

Area $\triangle PSR = \frac{1}{2}(7)(8) \sin 46{,}6°$

$= 20{,}34$

8.



8.1 $A\hat{C}B = C\hat{A}X$ (alt. ∠s, AX ∥ BCD)

$= 74°$

8.2 $\sin = 74° = \frac{112}{AC}$

9.2 In $\triangle PBC$: $\frac{PC}{\sin P\hat{B}C} = \frac{BC}{\sin B\hat{P}C}$

$\therefore \frac{PC}{\sin 122{,}4°} = \frac{5{,}5}{\sin 4{,}3°}$ ($B\hat{P}C = 36{,}7° - 32{,}4°$)

$\therefore PC = \frac{5{,}5 \sin 122{,}4°}{\sin 4{,}3°}$

$= 61{,}9$ m

9.3 In $\triangle PAC$: $\frac{AP}{PC} = \cos A\hat{P}C$

$\therefore AP = PC \cos A\hat{P}C$

$= 61{,}9 \cos 36{,}7°$

$= 49{,}7$ m

10.1 In $\triangle ABD$: $\hat{D}_1 = 180° - (x + y)$ (sum ∠s of △BAD)

$\frac{BD}{\sin x} = \frac{p}{\sin[180° - (x + y)]}$

$\therefore BD = \frac{p \sin x}{\sin(x + y)}$

In $\triangle BCD$: $\hat{B}_1 = 90° - y$

$\sin(90° - y) = \frac{DC}{BD}$

$\therefore \cos y = \frac{DC}{\frac{P \sin x}{\sin(x+y)}}$

$\therefore DC = \frac{P \sin x}{\sin(x + y)}$

10.2 $DC = \frac{[\text{illegible}]}{\sin 150°}$

$= 33{,}7$ m

11.1 $K\hat{T}P = 90° - y$

11.2 In $\triangle KTP$:

$\frac{KT}{\sin x} = \frac{h}{\sin(90° - y)}$

$\therefore KT = \frac{h \sin x}{\sin(90° - y)}$

$= \frac{h \sin x}{\cos y}$

11.3 In $\triangle HTS$:

$\frac{ST}{h} = \tan z$

$\therefore ST = h \tan z$

11.4 Area $\triangle KTS = \frac{1}{2} KT \, . \, ST \, . \sin y$

$= \frac{1}{2}\left(\frac{h \sin x \, . \, h \tan z \, . \, \sin y}{\cos y}\right)$ (11.2 and 11.3)

$= \frac{1}{2} h^2 \sin x \tan z \tan y$

($\frac{\sin y}{\cos y} = \tan y$)

$\therefore$ AC = $\frac{112}{\sin 74°}$ = 116,51 m

8.3 $\hat{D} = D\hat{A}X = 66°$ (alt. ∠s, AX || BCD)
$C\hat{A}D = 8°$
In △ACD: $\frac{CD}{\sin 8°} = \frac{116{,}51}{\sin 66°}$
$\therefore$ CD = 17,75 m

9.1 $P\hat{B}C = \hat{A} + A\hat{P}B$ (ext. ∠ △ABP)
$= 90° + 32{,}4°$
$= 122{,}4°$

11.5 Area △KTS
$= \frac{1}{2}(28)^2 \sin 115{,}7° \tan 61{,}6° \tan 43{,}5°$
$= 620 \text{ m}^2$

12.