Precalculus Unit 6 Review

Part I: No Calculator

Find the exact value of each expression, in radians.

1. $\tan^{-1}(0)$

restricted $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$

$\tan(\theta) = 0$

$\tan\theta = 0$

$\boxed{\theta = 0}$

2. $\arcsin\left(\frac{\sqrt{3}}{2}\right)$

$\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ QI

$\sin^{-1}\left(\frac{\sqrt{3}}{2}\right)$ positive

$\boxed{\frac{\pi}{3}}$

3. $\sec^{-1}(-\sqrt{2})$

$\sec\theta = -\sqrt{2}$

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

restricted QII $[0, \pi]$

135°

$\boxed{\frac{3\pi}{4}}$

4. $\arctan(-\sqrt{3})$

$\tan^{-1}(-\sqrt{3})$

$\tan\theta = \frac{y}{x}$

-60°

$\boxed{-\frac{\pi}{3}}$

5. $\sec^{-1}\left(\frac{2\sqrt{3}}{3}\right)$

$\sec\theta = \frac{2\sqrt{3}}{3}$

$\cos\theta = \frac{3}{2\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right)$

$\cos\theta = \frac{\sqrt{3}}{2}$

positive QI

$\boxed{\frac{\pi}{6}}$

6. $\cos^{-1}(-1)$

$\cos\theta = -1$

$(-1, 0)$

180°

$\boxed{\pi}$

7. $\cot^{-1}(0)$

$\cot\theta = 0$

$0 = \frac{x}{y}$

$(0,1)$ $(1,0)$

$\boxed{\frac{\pi}{2}}$

restriction $(0, \pi)$

8. $\arcsin\left(\frac{-\sqrt{2}}{2}\right)$

$\sin^{-1}\left(\frac{-\sqrt{2}}{2}\right)$

$\sin\theta = \frac{-\sqrt{2}}{2}$ or $\frac{-1}{\sqrt{2}}$

restricted $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

$\boxed{-\frac{\pi}{4}}$

9. $\operatorname{arccsc}(-2)$

$\csc^{-1}(-2)$

$\csc\theta = -2$

$\sin\theta = -\frac{1}{2}$

$\boxed{-\frac{\pi}{6}}$

Find the exact value of each expression, in degrees.

10. $\cos^{-1}\left(-\frac{1}{2}\right)$

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

180°

$\boxed{120^\circ}$

11. $\arctan(1) = \theta$

$\tan^{-1}(1)$

$\tan\theta = 1$ $\frac{y}{x}$

$\boxed{45^\circ}$

12. $\cot^{-1}(-\sqrt{3})$

$\frac{x}{y}$ $\cot^{-1}(-\sqrt{3})$

neg QII

30°

$\boxed{150^\circ}$

13. $\arcsin\left(\frac{1}{2}\right)$

$\sin^{-1}\left(\frac{1}{2}\right)$

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

$\boxed{30^\circ}$

14. $\operatorname{arcsec}(2)$

$\sec^{-1}(2) = \theta$

$\sec\theta = 2$

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

60°

15. $\cos^{-1}(1) = \theta$

$\cos\theta = 1$

$(1, 0)$

0°

16. $\arctan\left(\frac{-\sqrt{3}}{3}\right) = \theta$

$\tan^{-1}\left(-\frac{\sqrt{3}}{3}\right)$

$\tan\theta = -\frac{\sqrt{3}}{3} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\tan\theta = \frac{-\cancel{3}\,1}{\cancel{3}\sqrt{3}}$ $\frac{-1}{\sqrt{3}}$ $\frac{y}{x}$

$\boxed{-30^\circ}$

17. $\csc^{-1}(-\sqrt{2}) = \theta$

$\csc\theta = -\sqrt{2}$

$\sin\theta = \frac{-1}{\sqrt{2}}$

$\boxed{-45^\circ}$

18. $\arcsin(-1) = \theta$

$\sin\theta = -1$

$(0,1)$ $(-1,0)$ $(1,0)$ $(0,-1)$

$\boxed{-90^\circ}$

Find the exact value of each composition.

19. $\arccos\left(\cos\left(\frac{11\pi}{6}\right)\right)$

$\cos^{-1}(\text{ratio}) = \theta$

$\frac{\sqrt{3}}{2}$ is ratio

$\cos^{-1}\left(\frac{\sqrt{3}}{2}\right) = \boxed{30°}$ $\boxed{\frac{\pi}{6}}$

20. $\tan^{-1}\left(\sin\left(\frac{\pi}{2}\right)\right) = \theta$

ratio

$\tan^{-1}(1) = \theta$

$\tan\theta = 1$

QI

$45°$

$\boxed{\frac{\pi}{4}}$

21. $\cot\left(\sec^{-1}(-2)\right)$

$\cot(\theta) = \text{ratio}$

$\sec^{-1}(-2)$

$\sec\theta = -2$

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

$120°$

$\cot\left(\frac{2\pi}{3}\right)$

$\frac{x}{y} = \boxed{\frac{-1}{\sqrt{3}}}$

22. $\tan\left(\cos^{-1}\left(\frac{8}{17}\right)\right)$

$\tan(\text{angle}) = \text{ratio}$

$\text{angle} = \cos^{-1}\left(\frac{8}{17}\right)$

$\cos\theta = \frac{8}{17}$ $\frac{x}{r}$

QI

$\tan\theta = \boxed{\frac{15}{8}}$ $\frac{y}{x}$

$y = \sqrt{17^2 - 8^2}$

$y = 15$

23. $\sin\left(\operatorname{arccot}\left(\frac{-12}{5}\right)\right)$

$\sin(\text{angle}) = \text{ratio}$

$\cot^{-1}\left(-\frac{12}{5}\right) = \theta$

$\frac{x}{y}$

$r = \sqrt{(-12)^2 + 5^2}$

$r = 13$

$\sin\theta = \boxed{\frac{5}{13}}$

Write an equivalent algebraic expression for each composition.

24. $\csc\left(\tan^{-1}(x)\right)$

$\csc(\theta) = \text{ratio}$

$\text{angle} = \tan^{-1}(x)$

$\tan\theta = x$ $\frac{\text{opp}}{\text{adj}} = \frac{x}{1}$

$r = \sqrt{1^2 + x^2}$

$\csc\theta = \frac{\text{hyp}}{\text{opp}}$ $\boxed{\frac{\sqrt{1+x^2}}{x}}$

25. $\sec\left(\arcsin\left(\frac{x}{2}\right)\right)$

$\sec\theta = \text{ratio}$

$\sin^{-1}\left(\frac{x}{2}\right) = \theta$

$\sin\theta = \frac{x}{2}$ $\frac{\text{opp}}{\text{hyp}}$

$\sqrt{4 - x^2}$

$\text{adj} = \sqrt{2^2 - x^2}$

$\sec\theta = \frac{r}{x}$ $\boxed{\frac{2}{\sqrt{4-x^2}}}$

26. $\cos\left(\sin^{-1}(4x)\right)$

$\cos\theta = \text{ratio}$

$\sin^{-1}(4x) = \theta$

$\text{adj} = \sqrt{1^2 - (4x)^2}$

$\text{adj} = \sqrt{1 - 16x^2}$

$\cos\theta = \boxed{\frac{\sqrt{1-16x^2}}{1}}$

Find all radian **real number solutions to each equation.**

27. $2\cos\theta - 1 = 0$

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

positive in QI and QIV

QI $\boxed{\theta = \frac{\pi}{3} + 2\pi k}$

QIV $\boxed{\theta = \frac{5\pi}{3} + 2\pi k}$

28. $2\cos^2\theta + \cos(2\theta) = 0$

$2\cos^2\theta + 2\cos^2\theta - 1 = 0$

$4\cos^2\theta - 1 = 0$

$4\cos^2\theta = 1$

$\cos^2\theta = \frac{1}{4}$

$\sqrt{\cos^2\theta} = \pm\sqrt{\frac{1}{4}}$

$\cos\theta = \pm\frac{1}{2}$

$\theta = \frac{\pi}{3} + 2\pi k$

$\theta = \frac{2\pi}{3} + 2\pi k$

$\theta = \frac{4\pi}{3} + 2\pi k$

$\theta = \frac{5\pi}{3} + 2\pi k$

$\theta = \frac{\pi}{3} + \pi k$

$\theta = \frac{2\pi}{3} + \pi k$

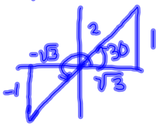
Find all angles in degrees that satisfy each equation.

29. $\tan(\theta/4) = \sqrt{3}/3$

$\tan\left(\frac{\theta}{4}\right) = \frac{\sqrt{3}}{3} \cdot \frac{\sqrt{3}}{\sqrt{3}}$

$\frac{3}{3\sqrt{3}} = \frac{1}{\sqrt{3}}$ $\frac{y}{x}$

positive QI, QIII



$\frac{\theta}{4} = 30° + 180°k$

$\boxed{\theta = 120° + 720°k}$

30. $\sin\theta\tan\theta - \sin\theta = 0$

$\sin\theta(\tan\theta - 1) = 0$

$\sin\theta = 0$ $\tan\theta - 1 = 0$

$\tan\theta = 1$

$\boxed{\theta = 0° + 180°k}$

$\boxed{\theta = 45° + 180°k}$

31. $3\cos x = 2\cos^2 x + 1$

$0 = 2\cos^2 x - 3\cos x + 1$

$0 = 2u^2 - 3u + 1$

$(2u - 1)(u - 1)$

$2\cos x - 1 = 0$ $\cos x - 1 = 0$

$2\cos x = 1$ $\cos x = 1$

$\cos x = \frac{1}{2}$ $\boxed{x = 0° + 360°k}$

$\boxed{x = 60° + 360°k}$

$\boxed{x = 300° + 360°k}$

or $x = -60° + 360°k$

Find all real number solutions to each equation in the interval $[0, 2\pi)$.

32. $\sqrt{3}\sin\theta = \sin(2\theta)$ radian

$\sqrt{3}\sin\theta = 2\sin\theta\cos\theta$

$\sqrt{3}\sin\theta - 2\sin\theta\cos\theta = 0$

$\sin\theta(\sqrt{3} - 2\cos\theta) = 0$

$\sin\theta = 0$ $\sqrt{3} - 2\cos\theta = 0$

$\boxed{0, \pi}$ $-2\cos\theta = -\sqrt{3}$

$\cos\theta = \frac{-\sqrt{3}}{-2}$

$\cos\theta = \frac{\sqrt{3}}{2}$

QI QIV

$\boxed{\frac{\pi}{6} \quad \frac{11\pi}{6}}$

33. $1 + \sin x = -\cos x$

$(1 + \sin x)^2 = (-\cos x)^2$

$1 + 2\sin x + \sin^2 x = \cos^2 x$

$\cancel{1} + 2\sin x + \sin^2 x = \cancel{1} - \sin^2 x$

$-1 \quad + \sin^2 x \quad -1 \quad + \sin^2 x$

$2\sin x + 2\sin^2 x = 0$

$2\sin x(1 + \sin x) = 0$

$2\sin x = 0$ $1 + \sin x = 0$

$\sin x = \frac{0}{2}$ $\sin x = -1$

$\sin x = 0$

$\boxed{\cancel{0}, \pi \quad \frac{3\pi}{2}}$

Is there an extraneous root?

$1 + \sin(0) \neq -\cos(0)$

$1 + \sin\pi \stackrel{?}{=} -\cos\pi$

$1 + \sin\frac{3\pi}{2} \stackrel{?}{=} -\cos\frac{3\pi}{2}$

34. $\sin x\cos(\pi/3) - \cos x\sin(\pi/3) = 1/2$

$a = x$ $b = \frac{\pi}{3}$

$\sin(a - b)$

$\sin\left(x - \frac{\pi}{3}\right) = \frac{1}{2}$ $\theta = x - \frac{\pi}{3}$

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

QI $x - \frac{\pi}{3} = \frac{\pi}{6} + 2\pi k$

$x = \frac{\pi}{6} + 2\pi k + \frac{\pi}{3}$

$k = 0$ $\frac{\pi}{6} + \frac{\pi}{3} = \frac{3\pi}{6}$ $\boxed{\frac{\pi}{2}}$

$k = 1$ too big $[0, 2\pi)$

QII $x - \frac{\pi}{3} = \frac{5\pi}{6} + 2\pi k$

$x = \frac{5\pi}{6} + \frac{\pi}{3} + 2\pi k$

interval is $[0, 2\pi)$

so I do not need $2\pi k$

$\boxed{x = \frac{7\pi}{6}}$

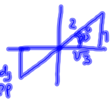
Find all angles in the interval $[0°, 360°)$ that are solutions to each equation.

35. $\cos(3\theta) = \sqrt{3}\sin(3\theta)$

angles are 3θ

$\frac{\cos(3\theta)}{\sin(3\theta)} = \frac{\sqrt{3}}{1}$

$\cot(3\theta) = \frac{\sqrt{3}}{1}$ adj / opp



QI $3\theta = 30° + 360K$

$\theta = \frac{30}{3} + \frac{360K}{3}$

$10° + 120°K$

QIII $\frac{3\theta}{3} = \frac{210°}{3} + \frac{360K}{3}$

$\theta = 70 + 120K$

$\boxed{10°, 130°, 250° \quad 70°, 190° + 310°}$

36. $0 = \sin(2x) - \sin^2(2x) + \cos^2(2x)$

$0 = \sin(2x) - \sin^2(2x) + 1 - \sin^2(2x)$

$0 = \sin(2x) - 2\sin^2(2x) + 1$

$2\sin^2(2x) - \sin(2x) - 1 = 0$

$2u^2 - u - 1 = 0$

$(2u+1)(u-1) = 0$

$2u + 1 = 0$ $\quad u - 1 = 0$

$2u = -1$ $\quad u = 1$

$u = -\frac{1}{2}$ $\quad \sin(2x) = 1$

$\sin(2x) = -\frac{1}{2}$ $\quad 2x = 90 + 360K$

QIII $2x = 210 + 360K$ $\quad x = 45 + 180K$

$x = 105 + 180K$

$\boxed{105°, 285°}$ $\quad \boxed{45° \quad 225°}$

QIV $2x = 330 + 360K$

$x = 165 + 180K$

$\boxed{165°; 345°}$

Part II: Calculator

Answer the question in complete sentences.

37. Explain how to determine how many triangles can be made when you are given the lengths of two sides and the measure of an angle that is not between the two sides. (SSA).

Draw △ with angle in left corner
put in the other 2 sides

Find height
$h = b\sin A$

zero triangle if $h > a$
height > right side (opp)

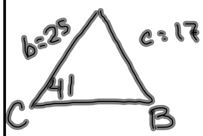
1 triangle if $h < a$ $a > b$
$h <$ rt side $\quad$ rt side > left side

2 triangles if $h < a < b$
height < right < left

If angle is obtuse
zero △ if rt < left, $a < b$
or 1 △ right side > left side, $a > b$

Determine the number of triangles with the given parts. Do not solve the triangles.

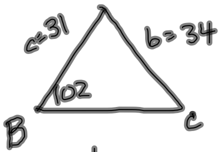
38. $\gamma = 41°,\ b = 25,\ c = 17$



$h = 25\sin 41$
$h = 16.4$
$16.4 < 17 < 25$
$\boxed{2 \text{ triangles}}$

39. $\beta = 102°,\ b = 34,\ c = 31$

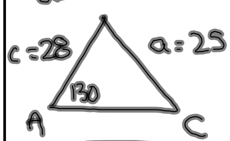
obtuse



$b > c$
$\boxed{1 \text{ triangle}}$

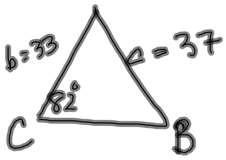
40. $\alpha = 130°,\ a = 25,\ c = 28$

obtuse



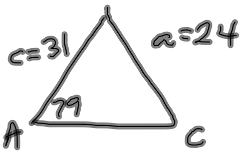
$\boxed{\text{no triangle}}$
$25 < 28$

41. $\gamma = 82°,\ b = 33,\ c = 37$



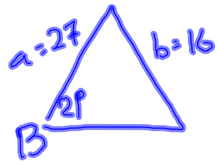
$h = 33\sin 82$
$h = 32.6$
1 triangle
$h < c$ $\quad c > b$
rt side $\quad$ rt > left

42. $\alpha = 79°$, $c = 31$, $a = 24$



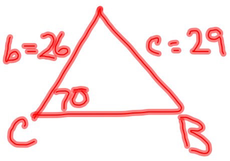
$h = 31\sin 79$
$h = 30.4$
$h > a$
$\boxed{\text{no triangle}}$

43. $\beta = 21°$, $a = 27$, $b = 16$



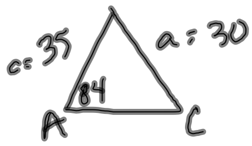
$h = 27\sin 21$
$h = 9.7$
$h < 16 < 27$
$\boxed{2\ \Delta s}$

44. $\gamma = 70°$, $c = 29$, $b = 26$



$h = 26\sin 70°$
$h = 24$ $\quad 24 < 29 \quad 29 > 26$
$\boxed{1\ \text{triangle}}$

45. $\alpha = 84°$, $a = 30$, $c = 35$

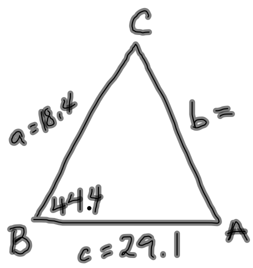


$h = 35\sin 84$
$h = 34.8$
$\boxed{\text{no triangle}}$

Solve all possible triangles with the given parts. Round to the nearest tenth.

46. $a = 18.4$, $\beta = 44.4°$, $c = 29.1$

$\boxed{\angle A = 38.9°}$ $\quad a = 18.4$
$\angle B = 44.4$ $\quad \boxed{b = 20.5}$
$\boxed{\angle C = 96.7°}$ $\quad c = 29.1$
$180 - 44.4 - 38.9$

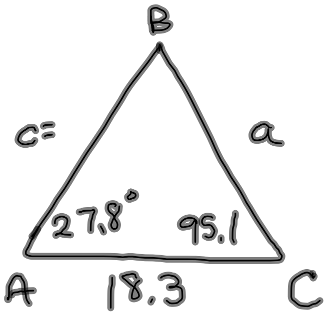


SAS
Law of Cosines

$b^2 = a^2 + c^2 - 2ac\cos B$
$b^2 = 18.4^2 + 29.1^2 - 2(18.4)(29.1)\cos 44.4$
$b^2 = 420.25$
$b = 20.5$

$\dfrac{\sin A}{18.4} = \dfrac{\sin 44.4}{20.5}$
$\sin A = 18.4\sin(44.4) \div 20.5$
$\sin A = .62799$
$\sin^{-1}(.62799) = \boxed{38.9°}$

47. $\alpha = 27.8°$, $\gamma = 95.1°$, $b = 18.3$



$\angle A = 27.8$

$\boxed{\angle B = 57.1}$

$180 - 27.8 - 95.1$

$\angle C = 95.1$

$\boxed{a = 10.2}$

$b = 18.3$

$\boxed{c = 21.7}$

ASA 1 triangle

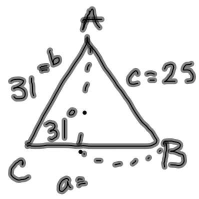
$\frac{\sin 27.8}{a} = \frac{\sin 57.1}{18.3}$

$a = 10.16$

$\frac{\sin 95.1}{c} = \frac{\sin 57.1}{18.3}$

$c = 21.7$

48. $\gamma = 31°$, $b = 31$, $c = 25$



$\boxed{\angle A_1 = 109.3}$ $\boxed{a_1 = 45.8}$

$\boxed{\angle B_1 = 39.7°}$ $b_1 = 31$

$\angle C_1 = 31°$ $c_1 = 25$

$h = 31 \sin 31$

$h = 15.9$

$15.9 < 25 < 31$

2 triangles

$\frac{\sin 31}{25} = \frac{\sin B}{31}$

$\sin B = 31 \sin 31 \div 25$

$\sin^{-1}(.6386) = B$

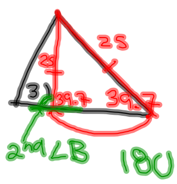
$B = 39.7°$

$\angle A = 180 - 39.7 - 31$

$\frac{\sin 109.3}{a} = \frac{\sin 31}{25}$

$\boxed{a = 45.8}$

$2^{nd} \Delta$



$180 - 39.7$

$\boxed{\angle A_2 = 8.7°}$ $\boxed{a_2 = 7.3}$

$\boxed{\angle B_2 = 140.3°}$ $b_2 = 31$

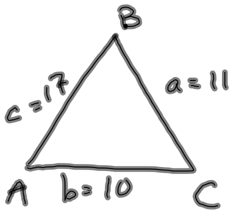
$\angle C_2 = 31$ $c_2 = 25$

$\angle A = 180 - 31 - 140.3$

$\frac{\sin 8.7}{a} = \frac{\sin 31}{25}$

$a = 7.3$

49. $a=11,\ b=10,\ c=17$



$\boxed{\begin{array}{l}\angle A = 38^\circ \\ \angle B = 34^\circ \\ \angle C = 108^\circ\end{array}}$

$180-38-34$

$a=11$
$b=10$
$c=17$

SSS

Law of Cosines

$b^2 = a^2 + c^2 - 2ac\cos B$

$10^2 = 11^2 + 17^2 - 2(11)(17)\cos B$

$100 = 121 + 289 - 374\cos B$

$100 = 410 - 374\cos B$
$-410 \quad -410$

$\frac{-310}{-374} = \frac{-374\cos B}{-374}$

$.8288 = \cos B$

$\cos^{-1}(.8288) = B$

$\boxed{\angle B = 34.0}$

$\frac{\sin 34}{11} =$

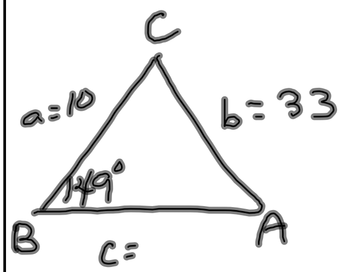
$\frac{\sin 34}{10} = \frac{\sin A}{11}$

$11\sin 34 \div 10 = \sin A$

$A = 38^\circ$

Solve all possible triangles with the given parts. Round to the nearest tenth.

50. $\beta = 149^\circ,\ a=10,\ b=33$



$\boxed{\angle A = 9^\circ}$

$\angle B = 149$

$\boxed{\angle C = 22^\circ}$

$180-149-9$

$a=10$

$b=33$

$\boxed{c=24}$

$h = 10\sin 149$

$h = 5.15$

$1\ \triangle$

$\frac{\sin 22}{c} = \frac{\sin 149}{33}$

$33\sin 22 \div \sin 149 = c$

$c = 24.0$

$\frac{\sin 149}{33} = \frac{\sin A}{10}$

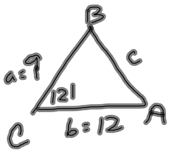
$10\sin 149 \div 33 = \sin A$

$.1561 = \sin A$

$A = 8.97 \quad 9.0^\circ$

Find the area of each triangle.

51. $a=9,\ b=12,\ \gamma=121°$



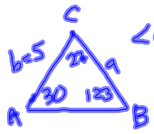
SAS

$\text{Area} = \frac{1}{2}\,\text{side}\cdot\text{side}\cdot\sin(\text{Angle})$

$\frac{1}{2}(12)(9)\sin 121$

$\boxed{A = 46.287}$

52. $\alpha=30°,\ \beta=123°,\ b=5$



$\angle C = 180-30-123$

$\angle C = 27$

$\frac{\sin 30}{a} = \frac{\sin 123}{5}$

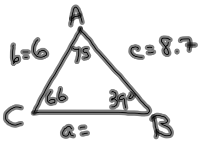
$5\sin 30 \div \sin 123$

2.92

$A = \frac{1}{2}(2.92)(5)\sin 27$

$\boxed{A = 3.3}$

53. $\gamma=66°,\ b=6,\ c=8.7$



$\frac{\sin 66}{8.7} = \frac{\sin B}{6}$

$6\sin 66 \div 8.7$

$B = 39°$

$180-39-66$

SAS

$A = \frac{1}{2}(6)(8.7)(\sin 75)$

$\boxed{A = 25.2}$

54. $a=4,\ b=8,\ c=10$

Heron!

$\frac{(4+8+10)}{2} = S$

$11 = S$

$A = \sqrt{11(11-4)(11-8)(11-10)}$

$\sqrt{231}$

$\boxed{15.2}$

55. $a=4.5,\ b=6,\ c=8.7$

$\frac{(4.5+6+8.7)}{2}$

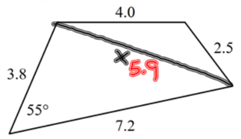
$S = 9.6 \quad A = \sqrt{9.6(9.6-4.5)(9.6-6)(9.6-8.7)}$

$A = \sqrt{158.6}$

$\boxed{12.6}$

Find the area of the figure below.

56.



SSS

Heron

$x^2 = 3.8^2 + 7.2^2 - 2(3.8)(7.2)\cos 55$

$x^2 = 34.89$

$\boxed{x = 5.9}$

$\frac{(4.0+2.5+5.9)}{2}$

$S = 6.2$

$\sqrt{6.2(6.2-4)(6.2-2.5)(6.2-5.9)}$

$\sqrt{15.14}$

$\boxed{3.89}$

SAS

$\text{Area} = \frac{1}{2}(3.8)(7.2)(\sin 55)$

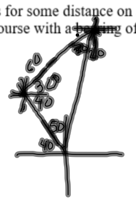
$\boxed{11.2}$

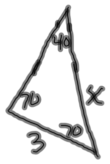
total area $11.2 + 3.89$

$\boxed{15.1}$

Solve. Round answers to the nearest tenth.

57. A canoe travels 3 miles from the coast to an island along a course with a bearing of 310°. It then turns and travels for some distance on a new course with a bearing of 60°, and finally returns back to its starting point on a course with a bearing of 200°. How far did the canoe travel on the final leg of its journey?



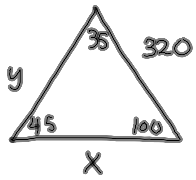


$$\frac{\sin 40}{3} = \frac{\sin 70}{x}$$

$$3\sin 70 \div \sin 40 = x$$

$$x \approx 4.4 \text{ mi}$$

58. A surveyor locating the corners of a triangular piece of property started at one corner and walked 320 ft in the direction S25°E to reach the next corner. The surveyor turned and walked S55°W to get to the next corner of the property. Finally, the surveyor walked in the direction N10°E to get back to the starting point. Find the perimeter and the area of the property.



$$\frac{\sin 45}{320} = \frac{\sin 35}{x}$$

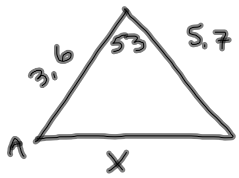
$$x = 259.6$$

$$\frac{\sin 45}{320} = \frac{\sin 100}{y}$$

$$y = 445.67$$

$$\boxed{x + y = 1025.3 \text{ ft}}$$

59. To find the distance between two small towns, an electronic distance measuring (EDM) instrument is placed on a hill from which both towns are visible. If the distance from the EDM to the towns is 3.6 miles and 5.7 miles and the angle between the two lines of sight is 53°, what is the distance between the towns?



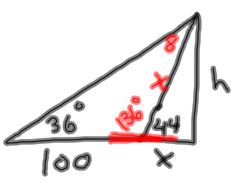
$$x^2 = 3.6^2 + 5.7^2 - 2(3.6)(5.7)\cos 53$$

$$x^2 = 20.75$$

$$x = 4.555$$

$$\approx \boxed{4.6 \text{ miles}}$$

60. A tourist spots a rock climber quite high up at Devil's Tower in Wyoming. The angle of elevation of the climber is 36°. From a point that is 100 ft. closer to the climber, the angle of elevation is 44°. What is the height of the climber, to the nearest foot?



$$\frac{\sin 8}{100} = \frac{\sin 36}{x}$$

$$x = 100\sin 36 \div \sin 8$$

$$x = 422.34$$

$$\frac{\sin 90}{422.34} = \frac{\sin 44}{h}$$

$$422.34\sin 44 \div \sin 90$$

$$h = 293.38 \text{ ft}$$

$$\approx \boxed{294 \text{ ft}}$$