

Law of cosines Coss Kunter
 SSS SAS

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$a^2 = b^2 + c^2 - 2bc \cos A$$

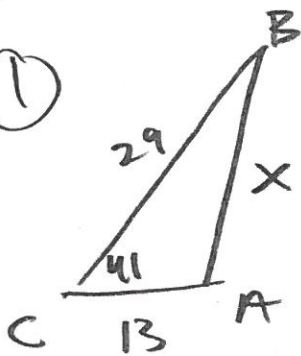
$$\cos B = \frac{a^2 + c^2 - b^2}{2ac}$$

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

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

①



SAS

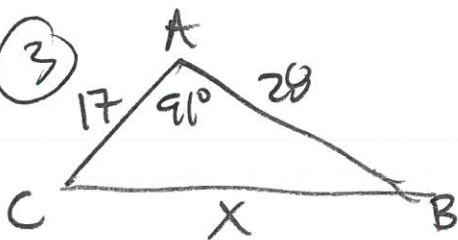
$$c^2 = 29^2 + 13^2 - 2(29)(13)\cos 41$$

$$c = \sqrt{29^2 + 13^2 - 2(29)(13)\cos 41}$$

$$c \approx 20.9988$$

$$AB = X = c = 20.9988$$

③



$$a^2 = b^2 + c^2 - 2bc \cos A$$

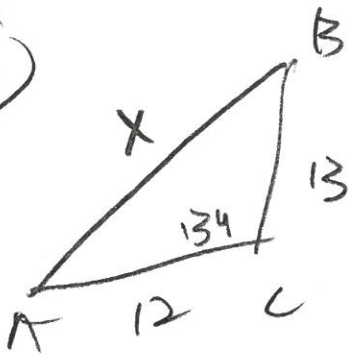
$$= 17^2 + 28^2 - 2(17)(28)\cos 91$$

$$a = \sqrt{17^2 + 28^2 - 2(17)(28)\cos 91}$$

$$a \approx 33.0093$$

$$a = cB = X = 33.0093$$

5



SAS

$$c^2 = a^2 + b^2 - 2ab \cos C$$

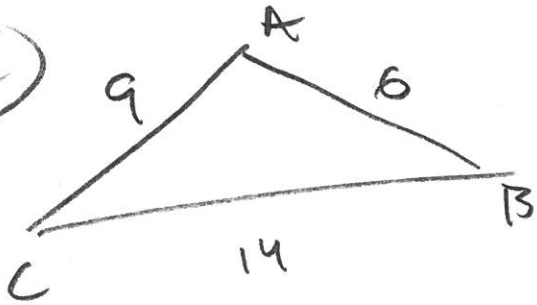
$$= 13^2 + 12^2 - 2(13)(12) \cos 134$$

$$c = \sqrt{13^2 + 12^2 - 2(13)(12) \cos 134}$$

$$c \approx 23.0159$$

$$c = AB = X = 23.0159$$

7



SSS

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

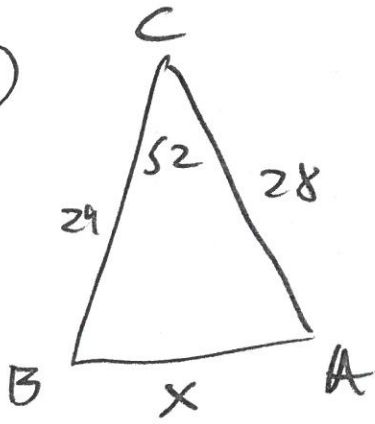
$$= \frac{14^2 + 9^2 - 6^2}{2(14)(9)}$$

$$\cos C = \frac{241}{252}$$

$$C = \cos^{-1}\left(\frac{241}{252}\right)$$

$$C \approx 16.9913^\circ$$

9



SAS

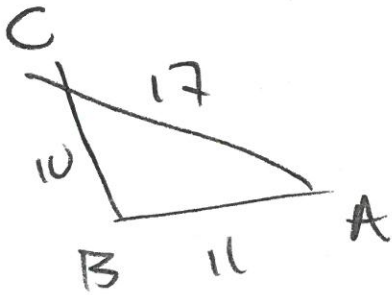
$$c^2 = a^2 + b^2 - 2ab \cos C$$

$$= 29^2 + 28^2 - 2(29)(28) \cos(52)$$

$$c = \sqrt{29^2 + 28^2 - 2(29)(28) \cos 52}$$

$$c = 25.0033$$

11



SSS

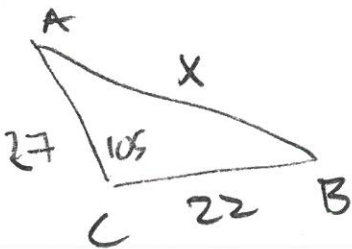
$$\cos A = \frac{17^2 + 11^2 - 10^2}{2(17)(11)}$$

$$\cos A = \frac{310}{374}$$

$$A = \cos^{-1}\left(\frac{310}{374}\right)$$

$$A \approx 34.0164^\circ$$

13



$$c^2 = 27^2 + 22^2 - 2(27)(22) \cos(105)$$

$$c = \sqrt{27^2 + 22^2 - 2(27)(22) \cos 105}$$

$$c \approx 38.9933$$

$$\cos A = \frac{27^2 + 38.9933^2 - 22^2}{2(27)(38.9933)}$$

$$\cos B = \frac{22^2 + 38.9933^2 - 27^2}{2(22)(38.9933)}$$

$$\cos B = \frac{1275.48}{1715.7}$$

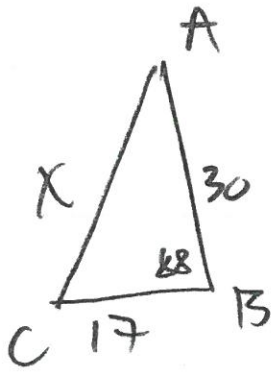
$$B = \cos^{-1}\left(\frac{1275.48}{1715.7}\right)$$

$$\approx 41.977^\circ$$

$$\cos A = \frac{1765.48}{1715.7}$$

$$A = \cos^{-1}\left(\frac{1765.48}{1715.7}\right) = 39.023^\circ$$

(15)



SAS

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

$$= (17)^2 + 30^2 - 2(17)(30) \cos 89$$

$$b = \sqrt{17^2 + 30^2 - 2(17)(30) \cos 89}$$

$$b \approx 33.9618$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$= \frac{33.9618^2 + 30^2 - 17^2}{2(33.9618)(30)}$$

$$\cos A = \frac{1764.4}{2037.71}$$

$$A = \cos^{-1}\left(\frac{1764.4}{2037.71}\right)$$

$$A \approx 30.0171^\circ$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

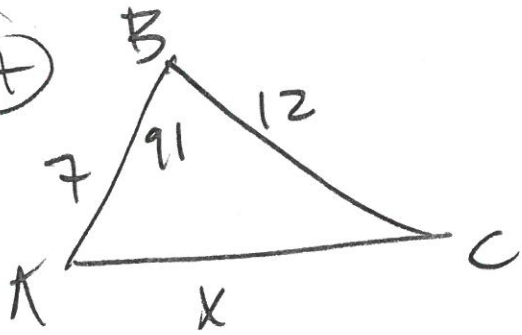
$$= \frac{17^2 + 33.9618^2 - 30^2}{2(17)(33.9618)}$$

$$\cos C = \frac{542.403}{1154.7}$$

$$C = \cos^{-1}\left(\frac{542.403}{1154.7}\right)$$

$$\approx 61.9829$$

(17)



SAS

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

$$= 12^2 + 7^2 - 2(12)(7) \cos 91$$

$$b = \sqrt{12^2 + 7^2 - 2(12)(7) \cos 91}$$

$$b = 13.9976$$

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

$$= \frac{13.9976^2 + 7^2 - 12^2}{2(13.9976)(7)}$$

$$\cos A = \frac{100.932}{195.966}$$

$$A = \cos^{-1} \left(\frac{100.932}{195.966} \right)$$

$$\approx 58.9993^\circ$$

$$\cos C = \frac{a^2 + b^2 - c^2}{2ab}$$

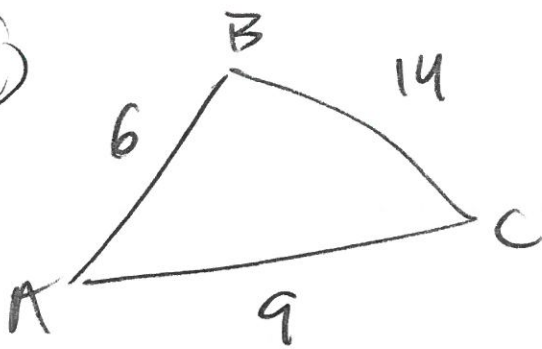
$$= \frac{12^2 + 13.9976^2 - 7^2}{2(12)(13.9976)}$$

$$\cos C = \frac{290.932}{335.942}$$

$$C = \cos^{-1} \left(\frac{290.932}{335.942} \right)$$

$$C \approx 30.0007$$

(19)



$$\cos A = \frac{b^2 + c^2 - a^2}{2bc} = \frac{9^2 + 6^2 - 14^2}{2(9)(6)} = \frac{-79}{108}$$

$\cos A = \frac{-79}{108}$ ← obtuse ratio < 0

$$A = \cos^{-1}\left(\frac{-79}{108}\right) \approx 137.011^\circ$$

$$\cos B = \frac{a^2 + c^2 - b^2}{2ac} = \frac{14^2 + 6^2 - 9^2}{2(14)(6)} = \frac{151}{168}$$

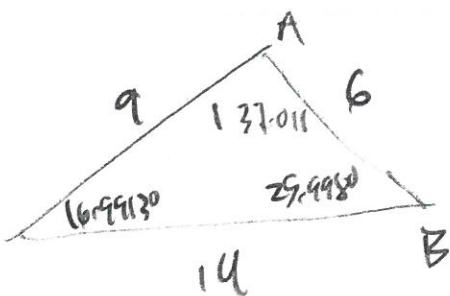
$\cos B = \frac{151}{168}$ ← acute ratio > 0

$$B = \cos^{-1}\left(\frac{151}{168}\right) \approx 29.998^\circ$$

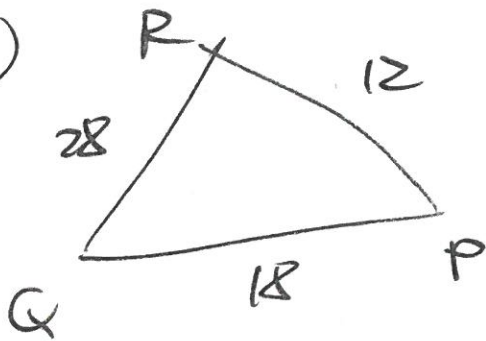
$$\cos C = \frac{a^2 + b^2 - c^2}{2ab} = \frac{14^2 + 9^2 - 6^2}{2(14)(9)} = \frac{241}{252}$$

$\cos C = \frac{241}{252}$

$$C = \cos^{-1}\left(\frac{241}{252}\right) \approx 16.9913^\circ$$



(21)



SSS

$$\cos Q = \frac{r^2 + p^2 - q^2}{2rp} = \frac{18^2 + 28^2 - 12^2}{2(18)(28)} = \frac{964}{1008}$$

$$\cos Q = \frac{964}{1008}$$

$$Q = \cos^{-1}\left(\frac{964}{1008}\right) \approx 16.9913^\circ$$

$$\cos R = \frac{q^2 + p^2 - r^2}{2(qp)} = \frac{12^2 + 28^2 - 18^2}{2(12)(28)} = \frac{604}{672}$$

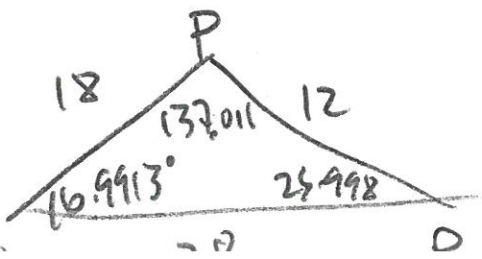
$$\cos R = \frac{604}{672}$$

$$R = \cos^{-1}\left(\frac{604}{672}\right) \approx 25.9998^\circ$$

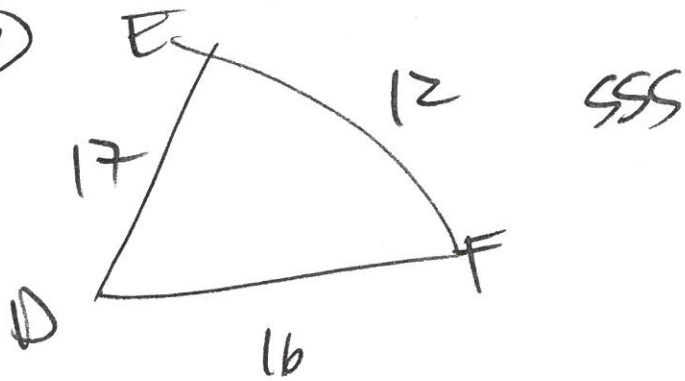
$$\cos P = \frac{r^2 + q^2 - p^2}{2rq} = \frac{18^2 + 12^2 - 28^2}{2(18)(12)} = \frac{-316}{432}$$

$$\cos P = \frac{-316}{432} \leftarrow \begin{array}{l} \text{obtuse} \\ \text{ratio} \\ < 0 \end{array}$$

$$P = \cos^{-1}\left(\frac{-316}{432}\right) \approx 137.011^\circ$$



23



$$\cos D = \frac{e^2 + f^2 - d^2}{2ef} = \frac{16^2 + 17^2 - 12^2}{2(16)(17)}$$

$$\cos D = \frac{401}{544}$$

$$D = \cos^{-1}\left(\frac{401}{544}\right) \approx 42.5123^\circ$$

$$\cos E = \frac{f^2 + b^2 - e^2}{2fd} = \frac{17^2 + 12^2 - 16^2}{2(17)(12)}$$

$$\cos E = \frac{177}{408}$$

$$E = \cos^{-1}\left(\frac{177}{408}\right) \approx 62.2898^\circ$$

$$\cos F = \frac{d^2 + e^2 - f^2}{2de} = \frac{12^2 + 16^2 - 17^2}{2(12)(16)}$$

$$\cos F = \frac{111}{384}$$

$$F = \cos^{-1}\left(\frac{111}{384}\right) \approx 73.1982^\circ$$

