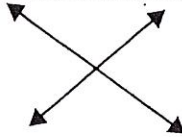


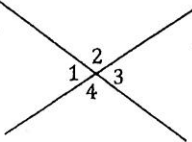
Vertical Angle Theorem

X marks the spot.

Okay, so vertical angles aren't nearly as fun to find as buried pirate treasure, but fortunately you don't have to sail the seven seas to find them. All you have to do is look for the "X". No, not the variable, but intersecting lines in the form of an X like this.

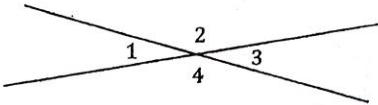


All you have to remember is that the angles on opposite sides of the x from one another are equal. Like this...



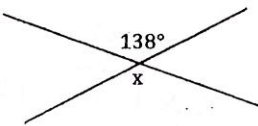
$$m\angle 1 = m\angle 3 \text{ and } m\angle 2 = m\angle 4$$

Pretty easy, huh? Here is an easy hint. It's impossible to draw a diagram without the vertical angles looking equal. So for vertical angles if they look equal they are equal. Watch...



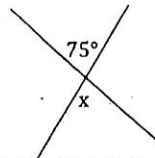
Angle 1 looks like it has the same measure as angle 3 doesn't it? "Yup," you say "they are both acute." Arrrrr maity! You'll walk the plank for callin' me angles cute! Okay, so maybe you won't be shark food, but you are correct. Also, angles 2 and 4 look the same and they both look obtuse. (By the way, just remember you can't count on an angle being a certain measure just because it looks like it. In this case we are only saying they LOOK equal, so they will be, but angles that look acute might not actually be.) Great, let's try some problems with vertical angles.

1. Find the measure of x.



Step 1. Write out the equation and relationship.

$$x = 138^\circ \text{ Vertical Angle Theorem}$$

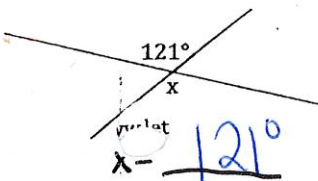


Step 1. Write out the equation and relationship.

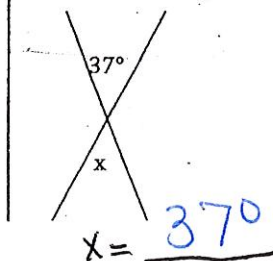
$$x = 75^\circ \text{ Vertical Angle Theorem}$$

For each, state the angle relationship and find the value of x.

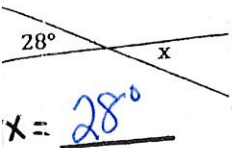
1.



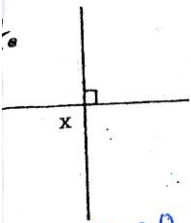
2.



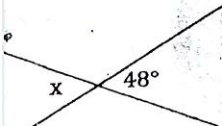
For each, state the angle relationship and solve for x.



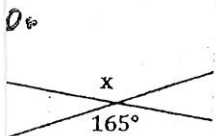
$x = \underline{28^\circ}$



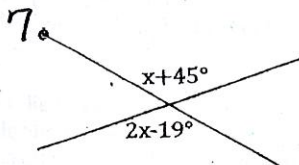
$x = \underline{90^\circ}$



$x = \underline{48^\circ}$



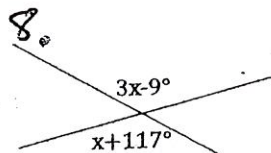
$x = \underline{165^\circ}$



$x+45^\circ = 2x-19^\circ$ Vertical Angle Theorem

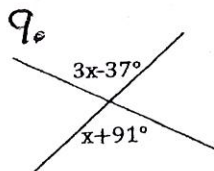
$-x \quad -x$
 $45^\circ = x+19^\circ$
 $-19^\circ \quad -19^\circ$

$\underline{26^\circ = x}$



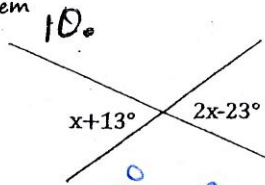
$3x-9 = x+117$

$\underline{x = 63}$



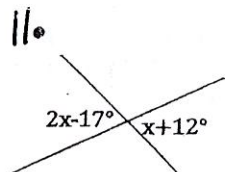
$3x-37 = x+91$

$\underline{x = 64}$



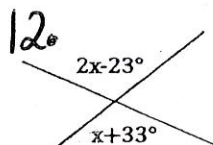
$x+13 = 2x-23$

$\underline{x = 36}$



$2x-17 = x+12$

$\underline{x = 29}$



$2x-23 = x+33$

$\underline{x = 56}$