

CUT & GLUE SORT

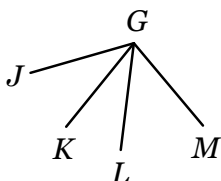
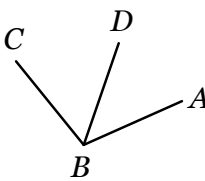
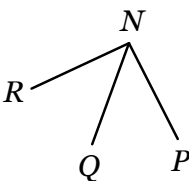
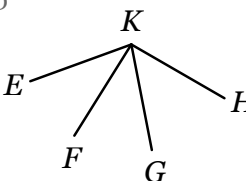


ANGLE ADDITION AND ANGLE BISECTORS

Angle Addition: Add, Take Away, or No Equation?

Where the rays are · when two angles make a third

FREE

A  $m\angle JGL = 67^\circ$, $m\angle KGM = 79^\circ$. Find $m\angle JGM$.	B  $m\angle ABD = 47^\circ$, $m\angle DBC = 58^\circ$. Find $m\angle ABC$.	C  $m\angle RNP = 92^\circ$, $m\angle PNQ = 47^\circ$. Find $m\angle RNQ$.	D  $m\angle GKF = 43^\circ$, $m\angle GKH = 49^\circ$. Find $m\angle FKH$.
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1. **Hand out pages 3 and 4**, one of each per student. Also hand out scissors and glue.
2. **Say this once:** *“Don't calculate anything. Look at where the rays are. Do the two given angles add up to the one you want? Is it what is left when you take one from the bigger angle? Or is a piece missing?”*
3. **Every row gets 4.** A row with more or fewer pieces has a piece in the wrong place. That is how you mark it in ten seconds.

Student sheets pages 3 and 4, one of each per student. A ray inside an angle, two angles sharing only the vertex, and a straight angle are on the first as pictures.

Answers page 5.

What the students sort. Each piece shows a few rays from one point, the sizes of two angles, and one angle asked for. Students do not calculate anything. They decide whether the angle asked for is the sum of the two, the difference, or cannot be found.

The third row is the hard one. Two angles add up to a third only when they share a ray and that ray is inside the angle asked for. Students easily miss this, because nothing on the page points to it. The four pieces in this row break that rule in different ways. The answer page gives the reason for each one. Piece C tests the same rule from the other side. Its two angles, $\angle RNP$ and $\angle PNQ$, are named as if they add up. But the ray they share is not inside $\angle RNQ$, so the answer is the difference.

The number of rays does not decide the row. Pieces with three rays and pieces with four rays are in more than one row. The order of the letters in the angle names does not decide it either. The drawings have no numbers. The sentence gives the sizes, and the drawing shows how the rays are arranged.



This is the free lesson this activity came from. The worksheet, the full answers and the lesson plan are on it, at three levels of difficulty.
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Add, take away, or no equation?

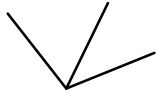
Angle addition

Name _____

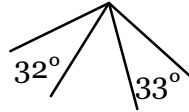
Period _____

Date _____

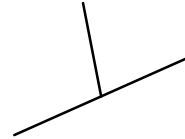
Cut out the twelve pieces on the next page. **Do not work anything out.** For each one, decide how the angle would be found. Then glue it into that row. **Two angles add up to a bigger one only when they share a ray. That ray must be inside the bigger angle.** The drawing shows where the rays are. The words give the sizes.



A ray inside the angle
the two parts add up to the whole



Share only the vertex
a piece between them is missing



A straight angle
measures 180°

ADD THE TWO. *The two given angles add up to make the angle asked for.*

TAKE ONE FROM THE OTHER. *The angle asked for is what is left when the smaller angle is taken from the bigger one.*

CANNOT TELL. *A piece is missing, or one angle is counted twice.*

The twelve pieces

Cut along the dotted lines

A $m\angle JGL = 67^\circ$, $m\angle KGM = 79^\circ$. Find $m\angle JGM$.	B $m\angle ABD = 47^\circ$, $m\angle DBC = 58^\circ$. Find $m\angle ABC$.	C $m\angle RNP = 92^\circ$, $m\angle PNQ = 47^\circ$. Find $m\angle RNQ$.	D $m\angle GKF = 43^\circ$, $m\angle GKH = 49^\circ$. Find $m\angle FKH$.
E $m\angle UTW = 36^\circ$, $m\angle XTY = 42^\circ$. Find $m\angle UTY$.	F $m\angle ADE = 123^\circ$, $m\angle CDE = 46^\circ$. Find $m\angle ADC$.	G $m\angle POQ = 34^\circ$, $m\angle QOR = 47^\circ$. Find $m\angle POR$.	H $m\angle SRT = 37^\circ$, $m\angle TRU = 35^\circ$. Find $m\angle URW$.
J $m\angle FEG = 112^\circ$, $m\angle FEH = 39^\circ$. Find $m\angle HEG$.	K $\angle AOC$ is a straight angle. $m\angle AOB = 52^\circ$. Find $m\angle BOC$.	L $m\angle YMW = 80^\circ$, $m\angle YMZ = 46^\circ$. Find $m\angle WMZ$.	M $m\angle AQB = 36^\circ$, $m\angle AQD = 110^\circ$. Find $m\angle CQD$.



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Cut & Glue Sort — answers

For the teacher

ADD THE TWO	B: $m\angle ABC = 105^\circ$. The two given angles add up to it.	D: $m\angle FKH = 92^\circ$. The two given angles add up to it.	G: $m\angle POR = 81^\circ$. The two given angles add up to it.	L: $m\angle WMZ = 126^\circ$. The two given angles add up to it.
TAKE ONE FROM THE OTHER	C: $m\angle RNQ = 45^\circ$. The shared ray NP is not inside $\angle RNQ$, so subtract: $92 - 47$.	F: $m\angle ADC = 77^\circ$. Subtract the smaller given angle from the bigger one.	J: $m\angle HEG = 73^\circ$. Subtract the smaller given angle from the bigger one.	K: $m\angle BOC = 128^\circ$. A straight angle is 180° , so subtract: $180 - 52$.
CANNOT TELL	A: $m\angle JGM$ cannot be found. The two given angles overlap. $\angle KGL$ is counted twice, and its size is not given.	E: $m\angle UTY$ cannot be found. The two given angles share only the vertex. $\angle WTX$ is missing.	H: $m\angle URW$ cannot be found. The angle asked for is outside both given angles. Neither of them reaches ray RW.	M: $m\angle CQD$ cannot be found. $\angle BQD$ can be found by subtracting, but nothing tells where ray QC splits it.

The angle sizes are for you, not for the students. Students are told not to calculate them. If a class finishes early, calculating them is a good next step. In the last row, a student who adds anyway gets a number that means nothing.

Guessing does not work. A student who sorts by a simple rule, such as the letters in the angle names or the number of rays, gets at most eight of the twelve pieces right.