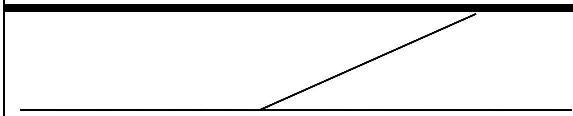
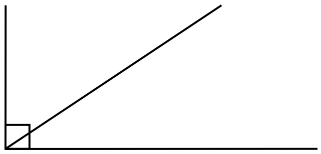
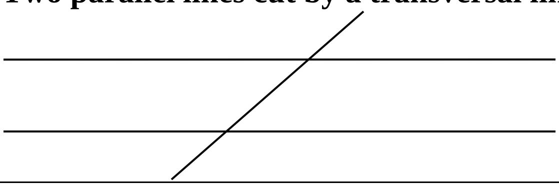
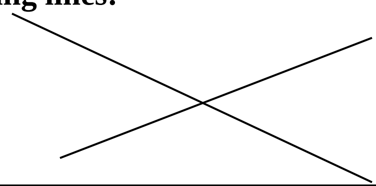
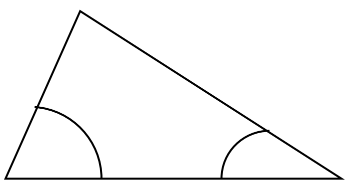
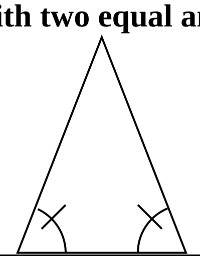
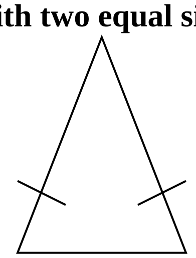
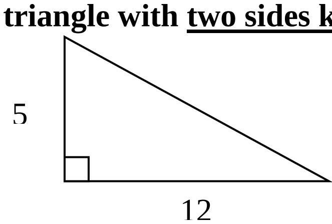
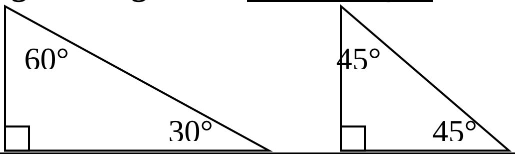
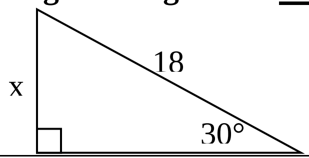
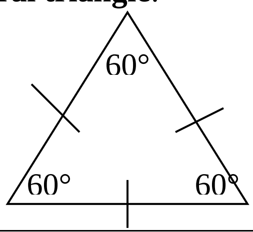
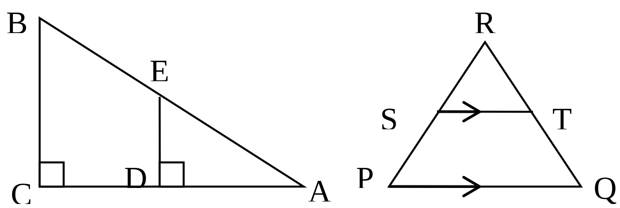
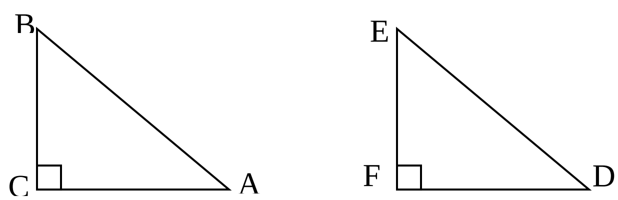
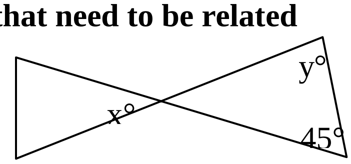
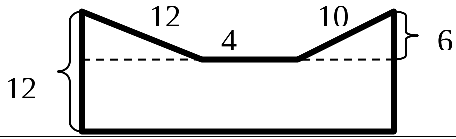
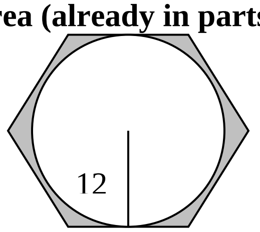
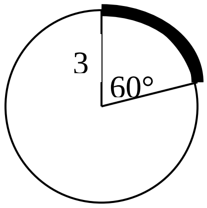
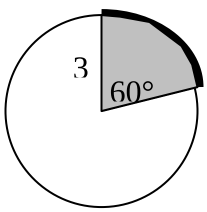
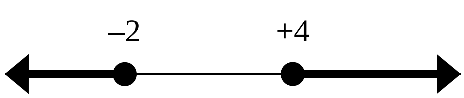
If You See…	You Should Think…
	Straight angle = 180°. Also, the sum of the two angles on each side of the straight line = 180° (they're supplementary).
	Right angle = 90°. Also, the sum of the two angles that make up the right angle = 90° (they're complementary).
Two parallel lines cut by a transversal line: 	If you know one angle you know all 8 angles.
Crossing lines: 	Vertical angles – the pairs of opposite angles are equal. The adjacent angles are supplementary (sum to 180°).
A triangle with angles marked: 	The sum of the angles in a triangle = 180°.
A triangle with two equal angles marked: 	Isosceles triangle – the two sides opposite the two angles are equal.
A triangle with two equal sides marked: 	Isosceles triangle – the two angles opposite the two sides are equal.
A right triangle with two sides known: 	Pythagorean Theorem – the square of one short side + the square of the other short side = the square of the hypotenuse. Also, look for 3-4-5, 6-8-10, and 5-12-13.

A right triangle with <u>special angles</u>:  	Special right triangle. The sides of a 30-60-90 triangle are in a ratio of 1: $\sqrt{3}$:2. The sides of a 45-45-90 are in a ratio of $\sqrt{2}:\sqrt{2}$:2.
A right triangle with <u>one side and one angle</u>:  	SOHCAHTOA: $\sin\theta = \frac{opp}{hyp}$ $\cos\theta = \frac{adj}{hyp}$ $\tan\theta = \frac{opp}{adj}$
An equilateral triangle:  	All sides are equal. All angles are equal (= 60°). The angle bisector of any angle also is a perpendicular bisector of the opposite side. That line segment also divides the triangle into two congruent 30-60-90 triangles. You can use that info to find the base and height of the equilateral triangle, and then find its area.
Similar triangles:  	<u>All three angles are equal</u>. Sides are <u>proportional</u>. In the examples at left, ΔABC is similar to ΔAED (ΔABC ~ ΔAED), and ΔPRQ ~ ΔSRT (because ST || PQ).
Congruent triangles:  	<u>All sides and angles are congruent</u>. There are three methods for determining congruence: • ASA • SAS • SSS In the example at left, if AC = DF and BC = EF (and the right angles are already given), then ΔABC is congruent to ΔDEF (ΔABC $\cong$ ΔDEF) because of SAS.
A diagram with two (widely separated) items that need to be related  What is x + y?	Build "bridges" between the two items using mathematical rules you know (for example, vertical angles, parallel line angles, etc.). In the example at left, build a bridge for x using vertical angles. Then x and y are in the same triangle, and x + y + 45 = 180, so x + y = 135.
A complicated area (divide into parts)  	Divide a complicated area into smaller areas for which you know a formula (e.g.., triangles, rectangles, etc.). In the example at left, the dotted lines divide the figure into two triangles and one rectangle.
A complicated area (already in parts)  	If an area is composed of two parts, find one small area by subtracting the other small area from the total area. In the example at left, subtract the circle area from the hexagon area to get the shaded area.

Sector of a circle (arc length):  	Circumference: full circumference equation is C = π * diameter (or 2π * radius). Arc length of a <u>sector</u> is <u>proportional</u> to the <u>central angle</u>. In the example at left: $\frac{sector\_length}{circumference} = \frac{central\_angle}{360°}$, so $\frac{sector\_length}{2\pi(3)} = \frac{60°}{360°}$ and sector_length = $\frac{6\pi}{6} = \pi$
Sector of a circle (area):  	Area: full area equation is A = πr^2. Area of a <u>sector</u> is <u>proportional</u> to the <u>central angle</u>. In the example at left: $\frac{sector\_area}{full\_area} = \frac{central\_angle}{360°}$, so $\frac{sector\_area}{\pi(3)^2} = \frac{60°}{360°}$ and sector_area = $\frac{9\pi}{6} = \frac{3\pi}{2}$
Parallel lines • If one line has equation y = 2x – 5, give an example of the equation of a parallel line.	**Parallel lines** have the <u>same slopes</u>. In the example at left, any line with slope 2 works: e.g., y = 2x + 3.
Perpendicular lines • If one line has equation y = 2x – 5, give an example of the equation of a perpendicular line.	**Perpendicular lines** have <u>slopes that are negative reciprocals</u>. In the example at left, any line with slope $\frac{-1}{2}$ works: e.g., y = $\frac{-1}{2}x + 3$.
Line equation given the slope and y-intercept • If a line has slope –1 and y-intercept (0, 3), what is its equation?	Slope-intercept form: **y = mx + b** In the example at left, m = –1 and b = 3, so the line equation is y = –x + 3.
Line equation given the slope and another point • If a line has slope –1 and passes through (3, 2), what is its equation?	Point-slope form: **$y - y_1 = m(x - x_1)$** In the example at left, m = –1, so the line equation is y – 2 = –(x – 3). Simplifying gives y = –x + 5.
Line equation given two points • If a line passes through the two points (–1, 1) and (1, 3), what is its equation?	Point-slope form: **$y - y_1 = m(x - x_1)$** In the example at left, find m = $\frac{3-1}{1-(-1)} = \frac{2}{2} = 1$. Pick one point (1, 3) and write the equation y – 3 = 1(x – 1). Simplifying gives y = x + 2.

Difference of squares: $x^2 - y^2$ • $x^2 - 4 = (x + 2)(x - 2)$ • $4y^2 - 9z^4 = (2y + 3z^2)(2y - 3z^2)$	<u>Factor</u> as **$(x + y)(x - y)$**.
The problem statement mentions "**integer**" • What are all the integer coordinates that lie within the rectangle with corners at (–2, 1), (2, 1), (2, –1), (–2, –1)?	You may be able to <u>list out (or draw) all possible integer choices</u> (this makes the problem easier!).
Odd/even problem statement • If x is even and y is odd, is xy^2 odd or even?	Try substituting odd/even <u>test values</u>. In the example at left, substitute x = 2, y = 1; then $xy^2 = 2(1)^2 = 2$ (even).
Positive/negative problem statement • If x is positive and y is negative, is xy^2 positive or negative?	Try substituting positive/negative <u>test values</u>. In the example at left, substitute x = 1, y = –1; then $xy^2 = 1(-1)^2 = 1$ (positive).
Problem statement referencing "**divisibility**" If x is divisible by 3 and y is divisible by 2, is xy divisible by 6?	Try substituting appropriate test values. In the example at left, substitute x = 3, y = 4; then xy = 3(4) = 12, which is divisible by 6. Confirm with x = 6 and y = 4.
Problem statement referencing "**remainder**" If 5 consecutive integers are divided by 3, the remainders are 1, 2, 0, 1, and 2. Which of the integers is divisible by 3?	Try listing out candidate test values that meet the criterion. In the example at left, start by finding the first element. For example, 4 divided by 3 has a remainder of 1. The 5 consecutive integers are then 4, 5, 6, 7, and 8. The third item in the list is divisible by 3.
Inequality: "between" two values 	You can express the inequality in two ways: • $\lvert x - \text{midpoint} \rvert \le$ "radius" • midpoint – radius $\le x \le$ midpoint + radius In the example to left, $\lvert x - 1 \rvert \le 3$ <u>or</u> $-2 \le x \le 4$
Inequality: "outside" two values 	You can express the inequality in two ways: • $\lvert x - \text{midpoint} \rvert \ge$ "radius" • $x \le$ midpoint – radius <u>and</u> $x \ge$ midpoint + radius In the example to left, $\lvert x - 1 \rvert \ge 3$ <u>or</u> $x \le -2$ <u>and</u> $x \ge 4$
The problem statement asks for a "**non-simple result**" • If x + 2y = 5, what is 2x + 4y?	Look for a way of obtaining the non-simple result directly from the inputs (<u>with minimal computation</u>). In the example at left, note that 2x + 4y = 2(x + 2y), so 2x + 4y = 2 (5) = 10.

<table>
<tr>
<td>The problem statement talks about data for more than one time period (steps, days, years, etc.).

• The original price of a shirt is decreased 10%. Later, it is decreased an additional 20%. What is the net percent decrease from its original price?</td>
<td>Set up the data in a table. Include the time period as one column.

In the example at left, set up a table (and pick an original price that’s easy to use):
<table>
<tr><td>Time period</td><td>Price</td><td>Change</td></tr>
<tr><td>0</td><td>$100</td><td>–10%</td></tr>
<tr><td>1</td><td>$90</td><td>–20%</td></tr>
<tr><td>2</td><td>$72</td><td></td></tr>
</table>
</td>
</tr>
<tr>
<td>$x * y * z \neq 0$

$x * y * z = 0$</td>
<td><u>None</u> of x, y, or z = 0.

<u>One or more</u> of x, y, or z = 0.</td>
</tr>
<tr>
<td>Complicated-looking arithmetic

• $\frac{3}{5}\times\frac{5}{7}\times\frac{7}{9}\times\frac{9}{11}\times\frac{11}{13}=?$</td>
<td>Try to <u>simplify</u>.

In the example at left, you can cancel all numbers except 3 and 13. The answer is $\frac{3}{13}$.</td>
</tr>
<tr>
<td>Simultaneous equations

What are x and y if

$x + y = 3$ and
$x – y = 5$</td>
<td>There are 3 approaches (on the SAT) for solving (all with the plan to <u>eliminate</u> one variable):
• Add the equations
• Subtract the equations
• Substitute one equation into the other
In the example at left, note that y and –y are opposites. So, add them to get $2x = 8$. Then, $x = 4$. Substitute into the other equation to get $y = –1$.</td>
</tr>
<tr>
<td>Simultaneous equations with complicated result

What is $2x + 3y$ if

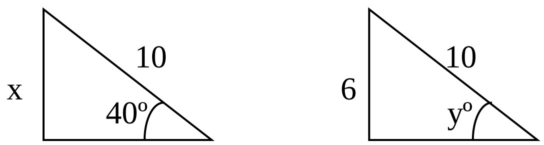
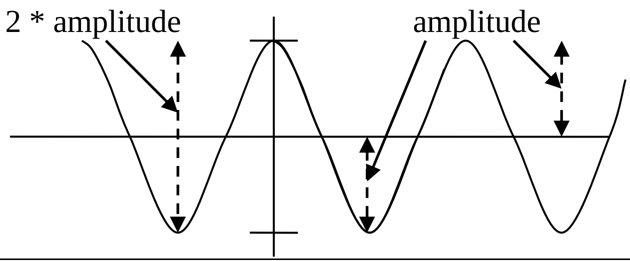
$x + y = 3$ and
$x + 2y = 5$</td>
<td>Same idea as above, but look for ways of <u>directly obtaining the result</u>:
• Add the equations
• Subtract the equations
• Substitute one equation into the other
In the example at left, note that if you add left sides of the two equations you get $2x + 3y$ (the complicated result that was asked for). So, $2x + 3y = 3 + 5 = 8$.</td>
</tr>
<tr>
<td>Opposites (e.g., x – 1 and 1 – x) in the same problem statement

• What is $(3x + y)(x – y) + (3x + y)(y – x)$?</td>
<td>See if you can replace one of the two with its opposite. That may simplify the equation.

In the example at left, note that $(y – x) = –(x – y)$. Substituting into the 2nd half of the problem gives:
$(3x + y)(x – y) – (3x + y)(x – y) = 0$. There is no need to multiply out all of the terms.</td>
</tr>
<tr>
<td>Relationship between two or more items (with different units)
Example: 1.25 inches relates to 30 miles; how many miles is 3.75 inches?</td>
<td>Ratio/Proportions

$\frac{30\ miles}{1.25\ inches}=\frac{x\ miles}{3.75\ inches}\Rightarrow x=90\ miles$</td>
</tr>
<tr>
<td>Least common multiple or denominator
• What is the least common multiple of 25, 8, and 30?</td>
<td>Factor each number into its prime factors. Look for the highest power of each prime factor. Multiply those together to get the least common multiple.

Example: $25 = 5^2$, $8 = 2^3$, $10 = 2 * 3 * 5$. The least common multiple = $5^2 * 2^3 * 3 = 600$.</td>
</tr>
</table>

A right triangle with two angles or one side and one angle 	SOHCAHTOA $\sin\theta = \frac{opp}{hyp}$ $\cos\theta = \frac{adj}{hyp}$ $\tan\theta = \frac{adj}{opp}$ Example (left): $\sin 40° = \frac{x}{10} \rightarrow 10\sin 40° = x \rightarrow x \approx 6.43$ Example (right): $\sin y° = \frac{6}{10} \rightarrow y = \sin^{-1}\left(\frac{6}{10}\right) \approx 36.87°$
A sinusoidal (sin or cos) graph 	y = a sin b(x + c). a = amplitude = ½ * distance from top to bottom b = 2π/(period) c = phase shift Know the graphs for **y = sin x** and **y = cos y**.
Trigonometric identities	$\sin^2\theta + \cos^2\theta = 1$ $\frac{\sin\theta}{\cos\theta} = \tan\theta$
Complex number	Complex numbers can be represented in two parts: *x* + *iy*, where *i* is the square root of –1. A complex number can be graphed as (x, y). The powers of i: $i = \sqrt{-1}$ $i^2 = -1$ and the cycle repeats in sets of 4. $i^3 = -i$ $i^4 = 1$
Matrices (added/subtracted)	Add/subtract corresponding elements. Example: $\begin{vmatrix}2 & 3\\4 & 5\end{vmatrix} + \begin{vmatrix}5 & 10\\15 & 20\end{vmatrix} = \begin{vmatrix}2+5 & 3+10\\4+15 & 5+20\end{vmatrix} = \begin{vmatrix}7 & 13\\19 & 25\end{vmatrix}$
Logarithms (converting to exponential form) <u>Remember</u>: **logarithms work like exponents**	The base of the logarithm is the base of the exponential. The value to which the logarithm is equal is the exponent. The value that the logarithm operates on is the "number." Thus, the exponential form is $base^{exponent} = number$ Example: $\log_3 9 = 2 \Rightarrow 3^2 = 9$
Logarithms (simplification rules) <u>Remember</u>: **logarithms work like exponents**	Adding logarithms → logarithm of the product • Example: log 3 + log 5 = log (3 * 5) = log 15 Subtracting logarithms → logarithm of the quotient • Example: log 15 – log 5 = log (15/5) = log 3 Logarithm of a power → product of the power and the logarithm • Example: $\log_3 5^2 = 2\log_3 5$