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Problem 1 *Give the definition of probability of a random event.*

Problem 2 *You roll two dice. List pairs of all the possible outcomes in the table below.*

Problem 3 *You roll two dice. What is the probability of scoring more than eight?*

$$P(\text{the score is } > 8) =$$

Problem 4 *A wooden cube is painted and cut into 512 smaller cubes of equal size. Then the little cubes are carefully mixed in a non-transparent bag. Once the mixing is finished, you pull out one of them. What is the chance that the cube you pull out has no paint on it?*

Problem 5 *You toss a coin 9 times. How likely are you to get at least one head?*

Problem 6 *Use factorials to compute the following numbers.*

a. $\binom{10}{0} =$

b. $\binom{10}{8} =$

Problem 7 Use Pascal's triangle to find $\binom{7}{5}$.

Problem 8 Simplify the following expression.

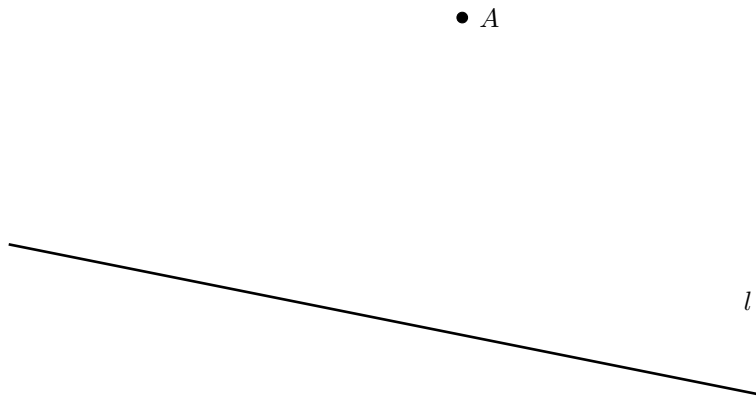
$$(x + y)^3 - \sum_{k=0}^3 \binom{3}{k} x^{3-k} y^k =$$

Problem 9 *You toss a fair coin 20 times. What is the chance that you get 4 tails?*

Problem 10 *There are two plates on the table. One plate has 12 identical candies, the other has 6 different fruits. How many ways are there to choose five candies and four fruits? (The treat will be put in a box, so the order does not matter.)*

Problem 11 *Formulate and prove the Pythagoras' Theorem.
Use the Claim/Reason chart.*

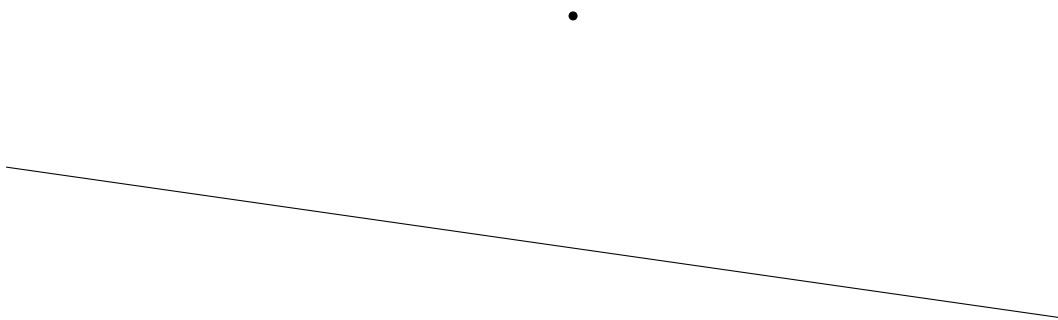
Problem 12 *Using a compass and a ruler, construct the shortest possible path from the point A to the straight line l below.*



Continues on the next page.

Use the Claim/Reason chart to prove that the path you have constructed is indeed the shortest.

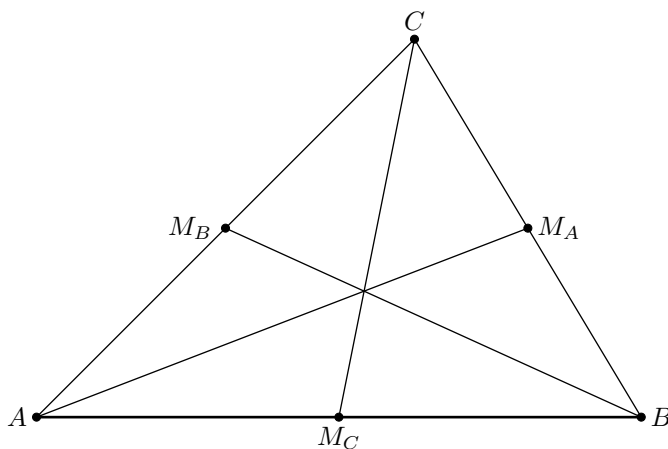
Problem 13 Use a compass and a ruler to draw a straight line parallel to the given one and passing through the given point below.



Problem 14 A boy weighing 60 lbs wants to lift his 180 lbs father using a 4-foot-long stick as a lever. Where should he place the fulcrum? Hint: a picture will help.

Problem 15 Find barycentric coordinates of the point $x = 3.2$.
Hint: a picture will help.

Problem 16 Prove that the medians of a triangle intersect at one point that divides each median in the ratio $2 : 1$ counting from the corresponding vertex.



Use the next page to make the Claim/Reason chart.

Problem 17 *Formulate a statement similar to that in Problem 16 for a triangular pyramid, called a simplex in the grown-up math, in a ten-dimensional space. Draw a 2D projection of the 10D simplex.*