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## Eureka!

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**A**rchimedes, the famous Greek scholar who lived in Syracuse, was frustrated by a problem the king had given him. The king suspected his goldsmith was cheating him; the king had given him gold to fashion a crown, and he thought the goldsmith was mixing in cheap metals.



Archimedes knew that he had to measure the volume of the crown to solve this problem, but it was in irregular shape. He went to relax and take a bath and think.

When he sat down in his bathtub, he noticed that the water level rose. The volume of water displaced, which could easily be easily, was exactly equal to the volume of his irregularly shaped body.

“Eureka!” He shouted, hopping out of his bath and running through the streets of Syracuse jubilant and naked. We are all familiar with this feeling, and call it many different things: “moment of clarity,” “aha feeling,” “light bulb moment” or “epiphany.”

When have you had this feeling in your life? What did you realize or discover?

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Explain the following sentence: "The haystack was important because the cloth ripped."

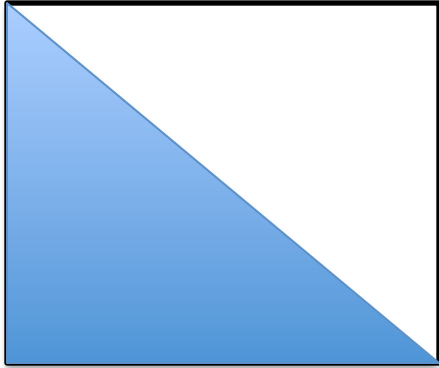
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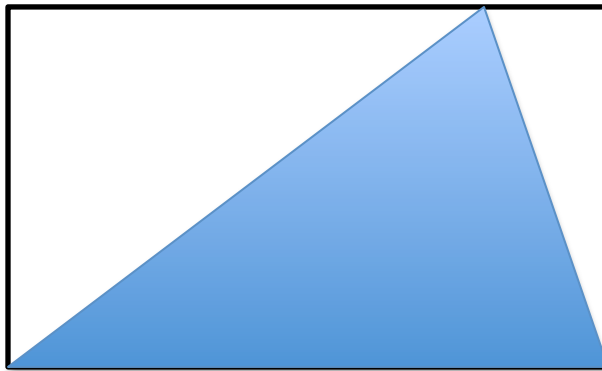
Here is a very easy geometry problem:

1. What percent, or fraction, of the square below is shaded?



Here is a problem that is slightly more difficult, but should be just as easy:

2. What percent, or fraction, of the rectangle below is shaded?

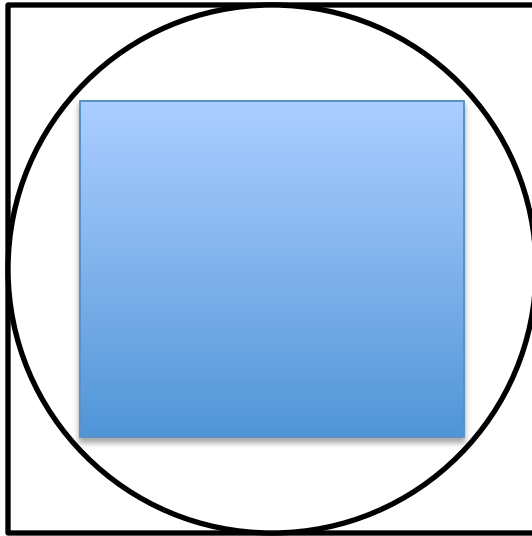


Explain your answer. You can use algebra, but a visual solution will receive full credit:

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A much harder, but related, problem:

3. In the figure below, the smaller square is inscribed in the circle and the circle is inscribed in the larger square. What fraction of the area of the larger square is the area of the smaller shaded square?



Work in groups, if necessary. Visual solutions receive full credit.

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4. You are presented with the following dataset. It is the result of a survey given to 30-year-old males. The researchers wanted to find out what causes happiness. Look at the data:

Name	Salary	Weight	Hours Worked Per Day	GPA in College	Married	Are you happy?
Jim	55K	145	5	3.8	no	no
Joe	33K	178	9	3.9	yes	yes
Sam	75K	190	3	2.5	yes	no
Bill	125K	230	4	3.7	no	no
Jamal	112K	185	10	3.1	yes	yes
Steven	88K	300	2	2	no	no
Eugene	32K	110	11	1.8	yes	yes
Sol	12K	150	10	2	no	yes
Chris	150K	152	9	3.2	yes	yes
Peter	200K	143	10	4.1	yes	yes
Chuck	68K	189	11	3.2	yes	yes
Mohammed	90K	190	5	3.1	no	no
Aadil	45K	220	6	3.1	yes	no
Rob	65K	210	5	2.9	no	no
Philip	76K	176	8	3.4	yes	yes
Mick	140K	173	5	3.5	yes	no
Scott	43K	199	9	3.1	yes	yes
Andre	28K	165	8	2.7	yes	yes
Samuel	34K	164	9	2.8	yes	yes
Stephen	41K	120	10	3.9	no	yes
Lloyd	47K	197	13	2.1	no	no
Leroy	75K	192	1	3.4	yes	no
John	98K	175	5	3.4	no	no
Maurice	49K	123	6	3.1	no	no
Sergio	52K	142	7	2.3	yes	yes
Sylvio	56K	187	8	2.2	no	yes
Julius	190K	155	12	3.9	no	no
Cletus	78K	156	10	3.4	yes	yes
Harvey	23K	160	8	2.7	yes	yes

What causes these men to say that they are happy? What is your theory?

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Here is another difficult problem. Work in groups. If you solve it, describe how you came to the insight. If you do not solve it, continue working on it for homework.

5. You have been taking two medicines for a month. You must take one pill of each medicine per day. If you accidentally take two of the same pill, you will die. The pills for both medicines are blue and round and have nothing distinguishing them. When you have two days left, you drop the four remaining pills on the ground. They all look the same. You cannot buy more medicine, as the company has gone out of business. If you don't take your medicine, you will die. How can you be sure that you are taking the correct pills? ("I'll just risk it" is not an appropriate answer)