

Venn Diagram Problems

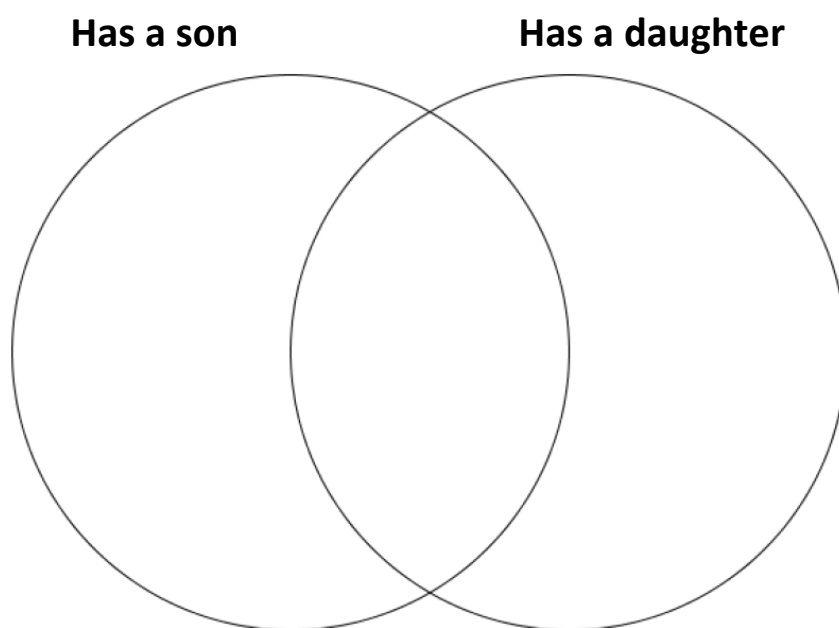
1. In a mums & toddlers group, 15 mums have a daughter, 12 mums have a son.

a) Julia says “ $15 + 12 = 27$ so there must be 27 mums altogether”.

Explain why she could be wrong:

b) There are actually 20 mums in the group altogether.

Fill in the Venn diagram below to show the **number of mums** in each section:



A mum is chosen at random from the group.

c) What is the chance that she has a son **and** a daughter?

d) What is the chance that she does **not** have a daughter?

e) What is the chance that she **has** a daughter, but **not** a son?

f) One week, all the mums with daughters go on a trip.

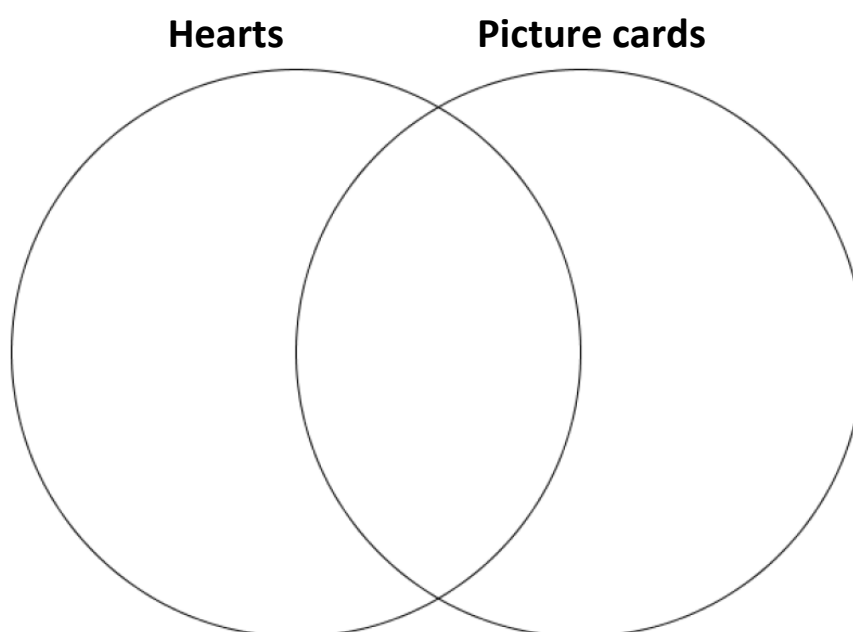
What fraction of the mums on this trip **also** have a son?

2. A deck of cards contains 52 cards in total. They are named from 2 to 10, and then Jack, Queen, King, Ace (these four are called 'picture cards').

They each also have a 'suit': Hearts, Diamonds, Clubs or Spades. See below:



a) Complete the Venn diagram below to show the **number of cards** in each part:



Remember, outside the circles you should put the number of cards that don't fit any of the categories.

b) A friend picks a card at random, and tells me it is a **picture card**.

What is the chance that it is also a **Heart**?

c) i. In a game, I win if I draw a **heart** or a **picture card** (or both).

My friend says: "The chance of getting a heart is $\frac{13}{52}$ and the chance of getting a picture card is $\frac{16}{52}$, so the chance of winning this game must be $\frac{29}{52}$."

He is wrong. Explain why:

ii. Work out my actual chance of winning, and decide if I am more likely to win or to lose.

Venn Diagram Problems HINTS

1.

a)

Which box would your mum tick on this form?

I have a son

I have a daughter

Is it possible someone could tick both? How would that affect the totals?

b)

If some people were counted twice, can you work out how many?

This will be the number in the overlap.

Remember that the **total** of all the numbers in the 'Has a son' circle must be 12.

This includes the mums who have a son but no daughters, and those with both.

c)

The probability is the number of mums with both a son and a daughter **out of** the total number of mums in the group. Use your Venn diagram to find out.

d)

Use your Venn diagram to find the total number **outside** the 'Has a daughter' circle. The probability will be this number **out of** the total number of mums.

e)

Use your Venn diagram to find the total number of mums in the 'Has a daughter' circle, but **not** in the 'Has a son' circle. The probability will be this number **out of** the total number of mums.

f)

Only look at the part of the Venn diagram showing you information about the mums with daughters. How many of them also have sons? The probability will be this **out of** the total number of mums **on the trip** (those with daughters).

2.

a)

First work out how many go in the middle: cards that are hearts but also picture cards (Jack, Queen, King or Ace). Use the image of all the cards to help count.

Next, work out how many hearts are not picture cards, for the rest of the 'Hearts' circle, and then how many picture cards are not hearts, for the rest of the 'Picture cards' circle.

Finally, work out how many you haven't included anywhere in the circles. This will be whatever is left over from the total of 52 cards.

b)

Only look at the 'Picture cards' circle. From **out of** these cards, how many are hearts? What fraction is this? That will be your probability.

c) i.

Imagine a game where you win if you get an even number on a dice or a number bigger than 3. There are 3 even numbers (2, 4 and 6), and there are 3 numbers bigger than 3 (4, 5 and 6), but there is also some overlap (4 and 6), so there are not 6 possible winning numbers in total. In fact, there are only 4 (2, 4, 5 and 6). This is a similar problem. If there is **overlap** between the categories, you can't just add the numbers together because you'll count some cards twice.

ii.

You need to find out how many cards are either a heart or a picture card or both, using your Venn diagram. The probability will be this number **out of** the total number of cards (52). If it's more than $\frac{1}{2}$, you are more likely to win than lose, but if it's less than $\frac{1}{2}$ you are more likely to lose.

Remember that half of 52 is 26, so $\frac{1}{2} = \frac{26}{52}$

Venn Diagram Problems SOLUTIONS

1. In a mums & toddlers group, 15 mums have a daughter, 12 mums have a son.

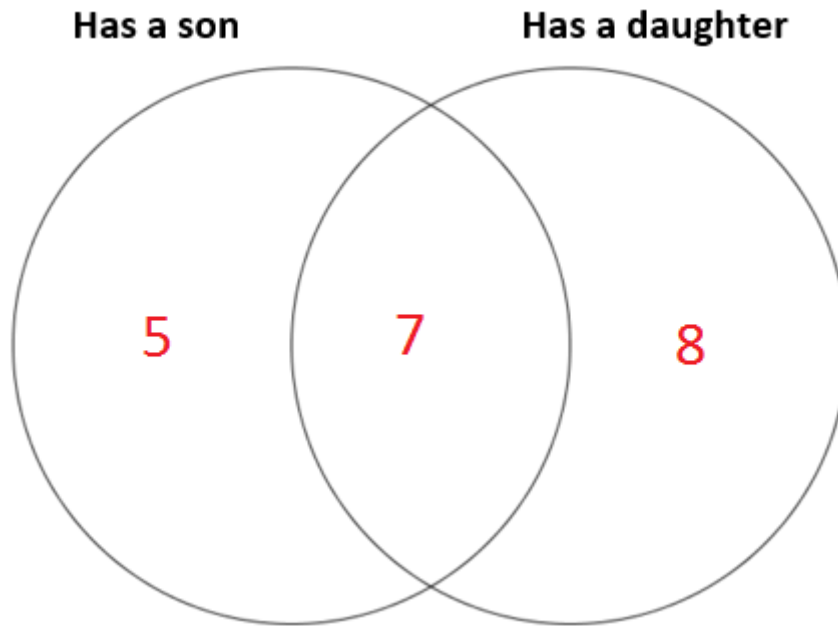
a) Julia says “ $15 + 12 = 27$ so there must be 27 mums altogether”.

Explain why she could be wrong:

Some mums may have a son *and* a daughter, and would have been counted twice.

b) There are actually 20 mums in the group altogether.

Fill in the Venn diagram below to show the **number of mums** in each section:



A mum is chosen at random from the group.

c) What is the chance that she has a son **and** a daughter?

$$\frac{7}{20} \text{ or } 28\% \text{ or } 0.28$$

d) What is the chance that she does **not** have a daughter?

$$\frac{5}{20} = \frac{1}{4} \text{ or } 25\% \text{ or } 0.25$$

e) What is the chance that she **has** a daughter, but **not** a son?

$$\frac{8}{20} = \frac{2}{5} \text{ or } 40\% \text{ or } 0.4$$

f) One week, all the mums with daughters go on a trip.

What fraction of the mums on this trip **also** have a son?

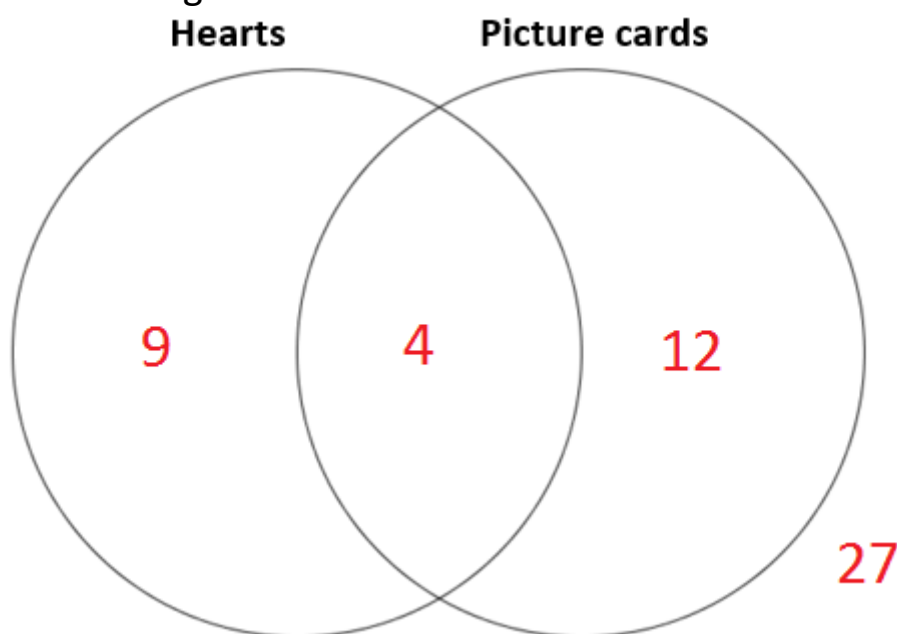
$$\frac{7}{15}$$

2. A deck of cards contains 52 cards in total. They are named from 2 to 10, and then Jack, Queen, King, Ace (these four are called 'picture cards').

They each also have a 'suit': Hearts, Diamonds, Clubs or Spades. See below:



a) Complete the Venn diagram below to show the **number of cards** in each part:



Remember, outside the circles you should put the number of cards that don't fit any of the categories.

b) A friend picks a card at random, and tells me it is a **picture card**.

What is the chance that it is also a **Heart**?

$$\frac{4}{16} = \frac{1}{4} \text{ or } 25\% \text{ or } 0.25$$

c) i. In a game, I win if I draw a **heart** or a **picture card** (or both).

My friend says: "The chance of getting a heart is $\frac{13}{52}$ and the chance of getting a picture card is $\frac{16}{52}$, so the chance of winning this game must be $\frac{29}{52}$."

He is wrong. Explain why:

There are 13 hearts and 16 picture cards, but because 4 cards are *both* hearts and picture cards, the total number of winning cards is only $13 + 16 - 4 = 25$.

ii. Work out my actual chance of winning, and decide if I am more likely to win

or to lose. $\frac{25}{52}$ Less than $\frac{26}{52}$ (which is $\frac{1}{2}$) so it is more likely to lose than win.