1. (public health)
   1. This is an observational study as you can not force people to smoke in order to conduct a study.
   2. From table 3:

From table 1:

From table 2:

It definitely seems like there is a correlation between age and smoking habits, as 44% of women smoke, 50% of women age 18-64 smoke, and only 20% of women age 65+ smoke. It seems like the correlation is that younger women are more likely to smoke.

I feel like you could argue it establishes a connection, however the difference between P(dead) and each of the two categories is only about so you could also argue its very weak. If you were to argue there is a connection it would actually point to smoking increasing morality. However, as I pointed out earlier this is not a very compelling argument given how close together the three values are.

* 1. From table 1:

From table 1:

From table 1:

From table 2:

From table 2:

From table 2:

Age is a confounding factor because when you don’t take it into account it appears as if smoking makes you live longer. However, when you look at the data in the context of restricted age groups you actually see in both instances that a higher percentage of smokers died than non-smokers. It probably goes in the opposite direction because more young people smoke, but young people are on average healthier than old people thus skewing the results.

* 1. The simpson's paradox occurs here because as I pointed out in (d) young people are both on average healthier and more likely to smoke than old people and we have almost five times as many young people as old people in the study; thus causing the incorrect correlation between smoking and living longer. Given how when we split up the age groups we saw smoking causing death in both groups I feel our conclusion in (d) is much more accurate.

1. (gambling)
   1. The odds are not 1 in 35,064,160,560 because that value assumes the order of the balls matters, however this is not the case, therefore you must divide by 5! as you need to negate the inclusion of order in the original calculation. This gives you the same odds as provided in the table: 1 in 292,201,338.
   2. The odds 1 in 11,238,513 are calculated not accounting for the person also getting the red ball incorrect. To get the correct answer you must multiply 11,238,513 by 25/26 in order to account for them getting the wrong red ball. When you do this calculation you get the correct answer of: 1 in 11,688,053.52.
   3. The first formula is correct because you need to determine the combinations within the winning 5 balls of size k, the number of incorrect balls (5 - k) out of the remaining 64 balls, 1 of 1 which is the correct red ball, 0 of 25 which is the remaining red balls, and then divide by the total number of 6 ball combinations. The second formula is correct because you you need to determine the combinations within the winning 5 balls of size k, the number of incorrect balls (5 - k) out of the remaining 64 balls, 0 of 1 which is the correct red ball that wasn’t pulled, 1 of 25 which is the 1 incorrect red ball pulled out of the other 25, and then divide by the total number of 6 ball combinations.

Odds from table 4:

All five whites and the red:

All five whites:

Four whites and the red:

Four whites:

Three whites and the red:

Three whites:

Two whites and the red:

One white and the red:

The red:

* 1. Given any of the outcomes in table 4 will result in a prize greater than $2 the odds of winning a prize is the odds of all of the possible prize outcomes connected with an or, aka you add them together. The statement needs word total, because 1 in 24.87 is the total odds for all of the possible prize outcomes.
  2. The chance of at least one grand prize winner is:

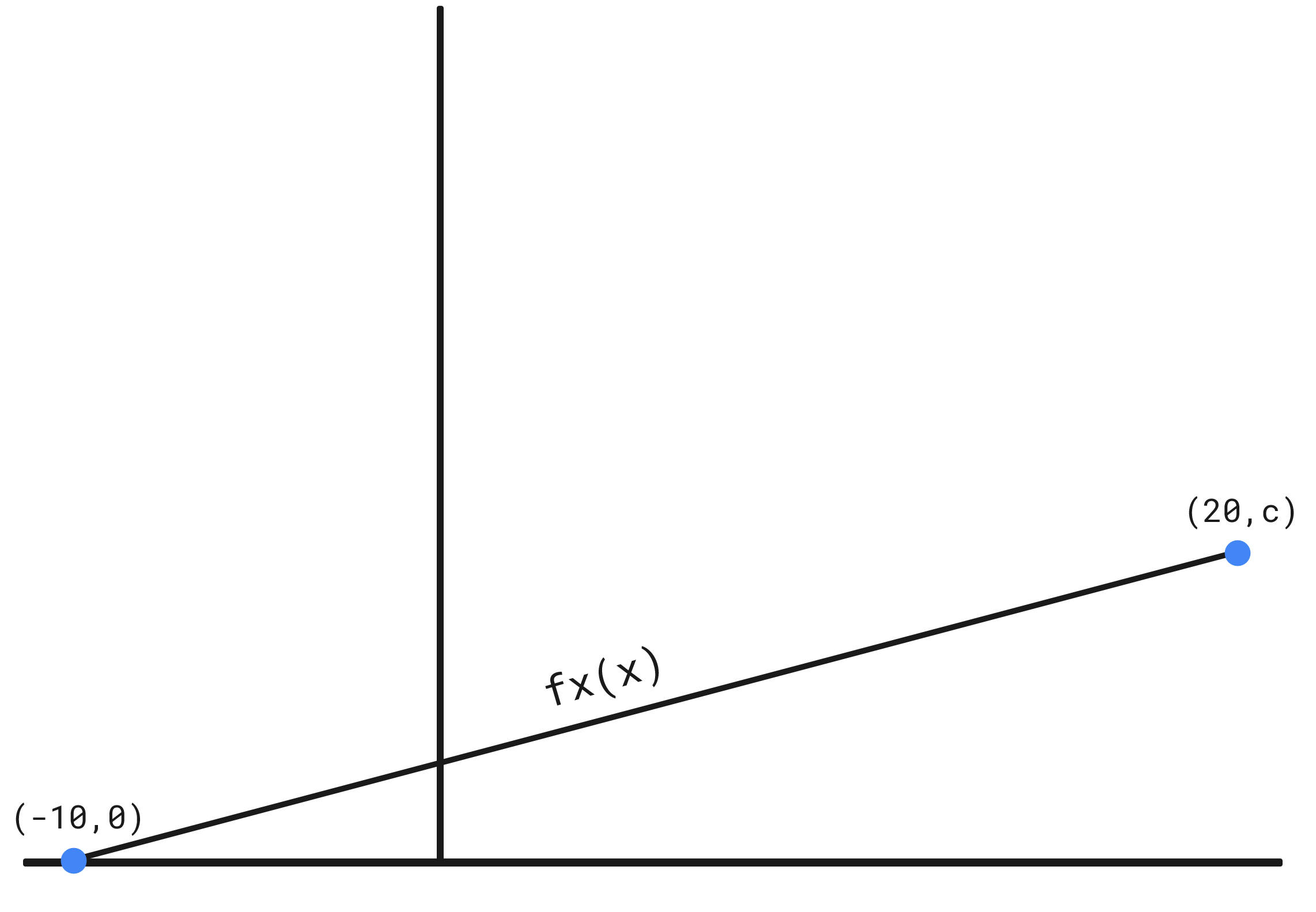
1. (logic and Bayes’s Theorem)

His probability of being pardoned does not change even though the warden provided him with new information, this is because the warden already made his decision randomly before the conversation making this information ultimately irrelevant to his fate. From a bayesian perspective his probability of being pardoned is not changed by the warden’s response as no matter the outcome, whether he is pardoned or not, at least one of his fellow inmates will not be pardoned; this makes the warden’s answer meaningless as he already knew another inmate would not be pardoned and he has no way to use the new information of that inmates identity to change his original odds. Even though it may appear as though new information has been acquired, thus enabling conditional probability, in fact the odds stay the same as we always knew at least one of the other inmates would not be pardoned.

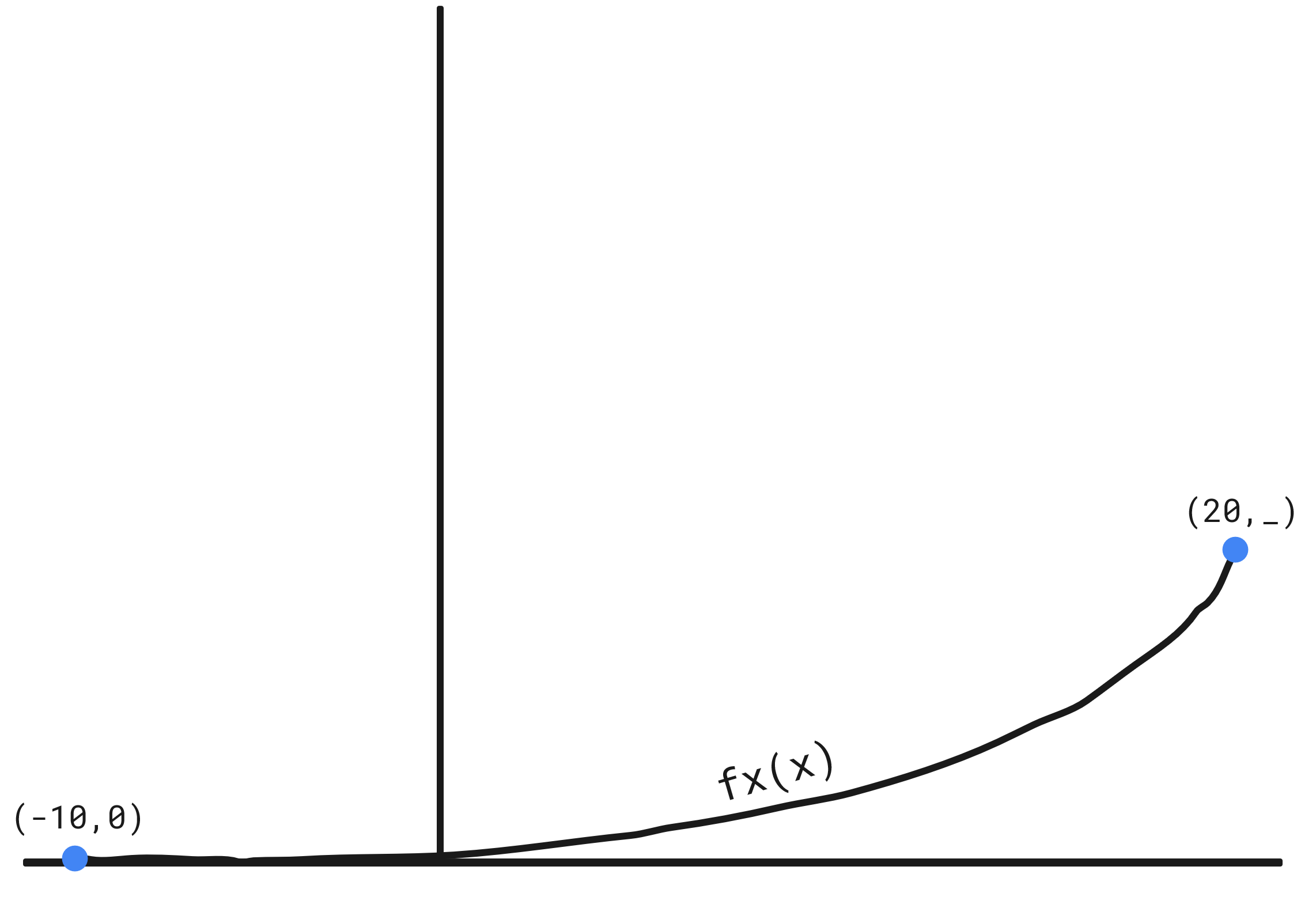
1. (optimal hiring strategy)
   1. For any i > r, when you interview the first i people, the probability that the best candidate is in the first r people is:
   2. The probability P(A|Bᵢ) = 0 for because you decided you would eliminate the first r interviewees automatically, therefore making it impossible you hire one even if they are the best candidate in the pool. The probability that the i is the best candidate and is hired for i > r is similar to (a) since if the ith person is the best pick and you chose them, that means at least one entry in r is better than all of the entries between r and i, therefore you just need the probability from (a) except instead of dividing by i you divide by i-1 as the best entry in r is only better than all of the candidates up too but not including the ith candidate.
      1. this is true because r is 0, therefore you will always pick the first candidate you meet making it completely random as too if they are the best candidate.
      2. The probability for a given r is found by connecting the probability of each candidate after r being the best with or, and then dividing by the total number of candidates n. This can be written out as:=
   3. Given that therefore:

The first element in the summation is and the rest of the added elements decrease until i = n. Therefore as r increases the elements of the summation decrease causing the function to decrease.

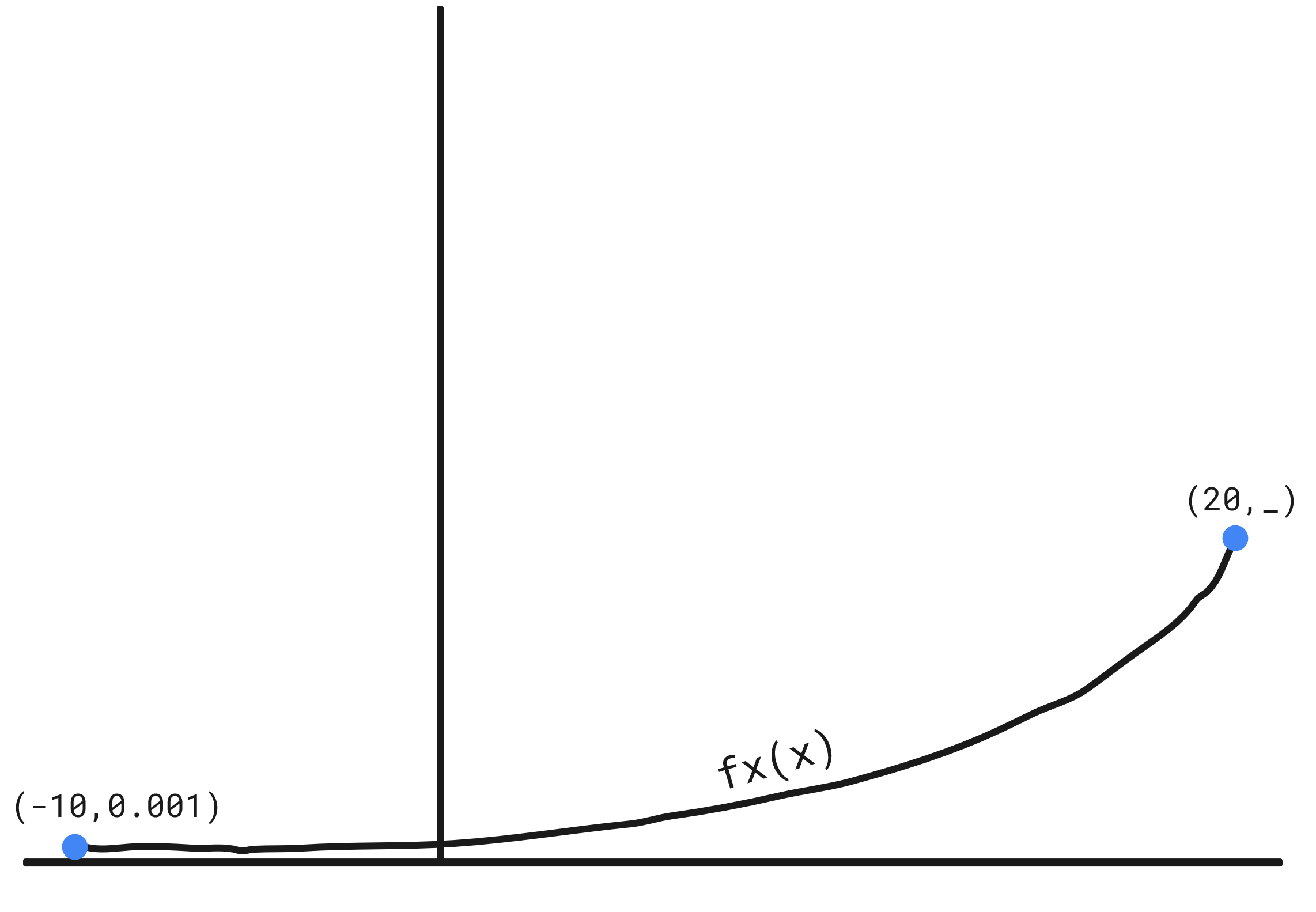
* 1. The value of is when the value of is less than that of , therefore the largest r such that is also the r that maximizes , as while .
  2. The best r for n = 10 is 3. This does not seem like a very good hiring strategy because even when you calculate the optimal r, you still only have about a 40% chance of hiring the correct candidate as .

1. (portfolio management)
   1. We are given therefore .We know from the definition of CDF that is an integral of the PDF , given this , thus . Since we know the relationship between our two PDFs is , , given this we can rewrite our earlier equation as: . Since is a CDF we know if we integrate it across the entire real number line the result will be 1 so we can further update our equation as . Given we are dealing with a CDF the input value must be -v giving us the expression: . Given this expression we know that .
   2. VaR seems very sensitive as its value is pretty varied depending on the PDF you choose.
      1. 

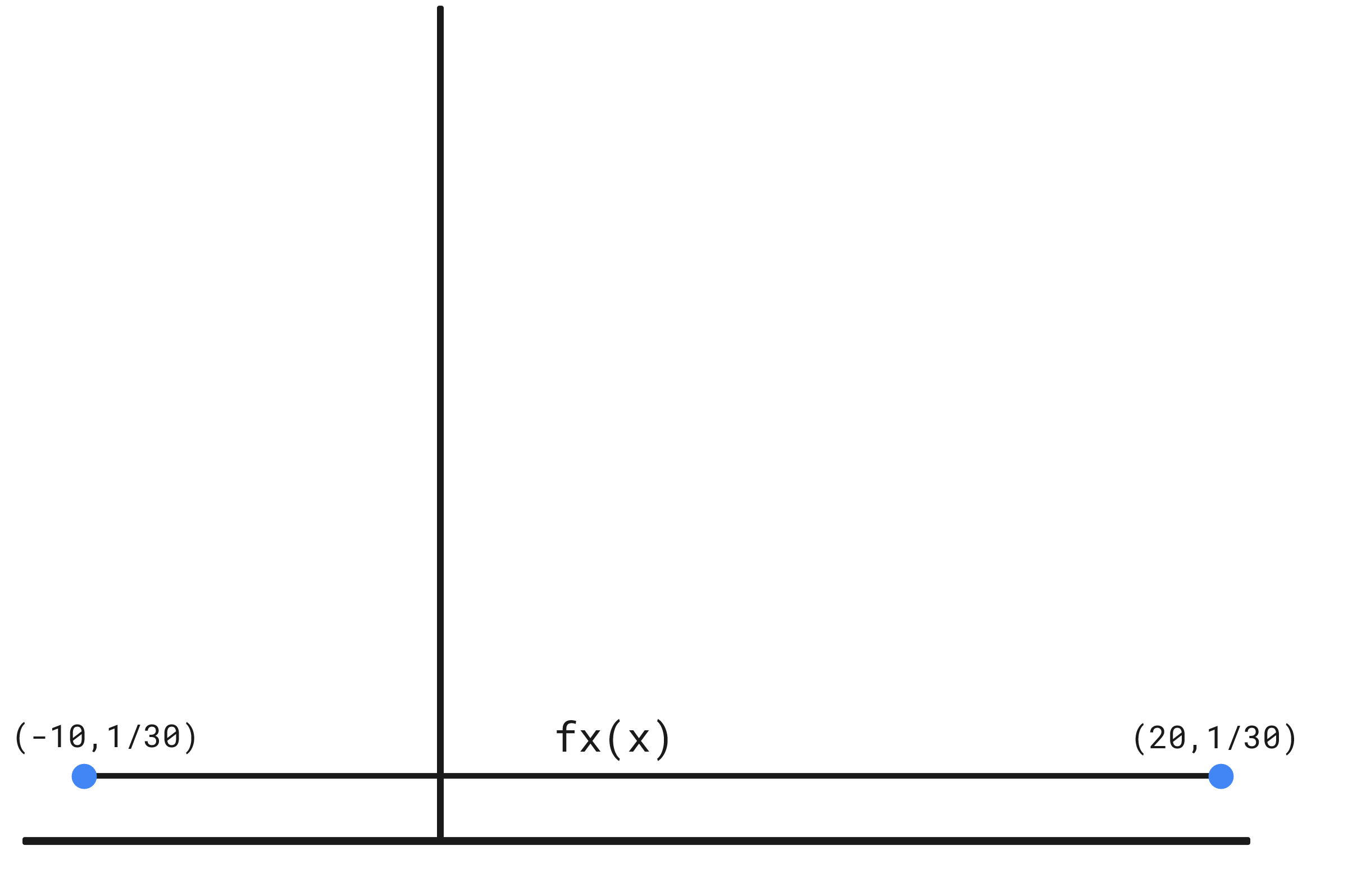
Since we know the function is only non-zero over [-10,20]: . Now that we know c we can define , therefore: . Given the definition we established in (a), and we are given that we can now calculate v: .

* + 1. 

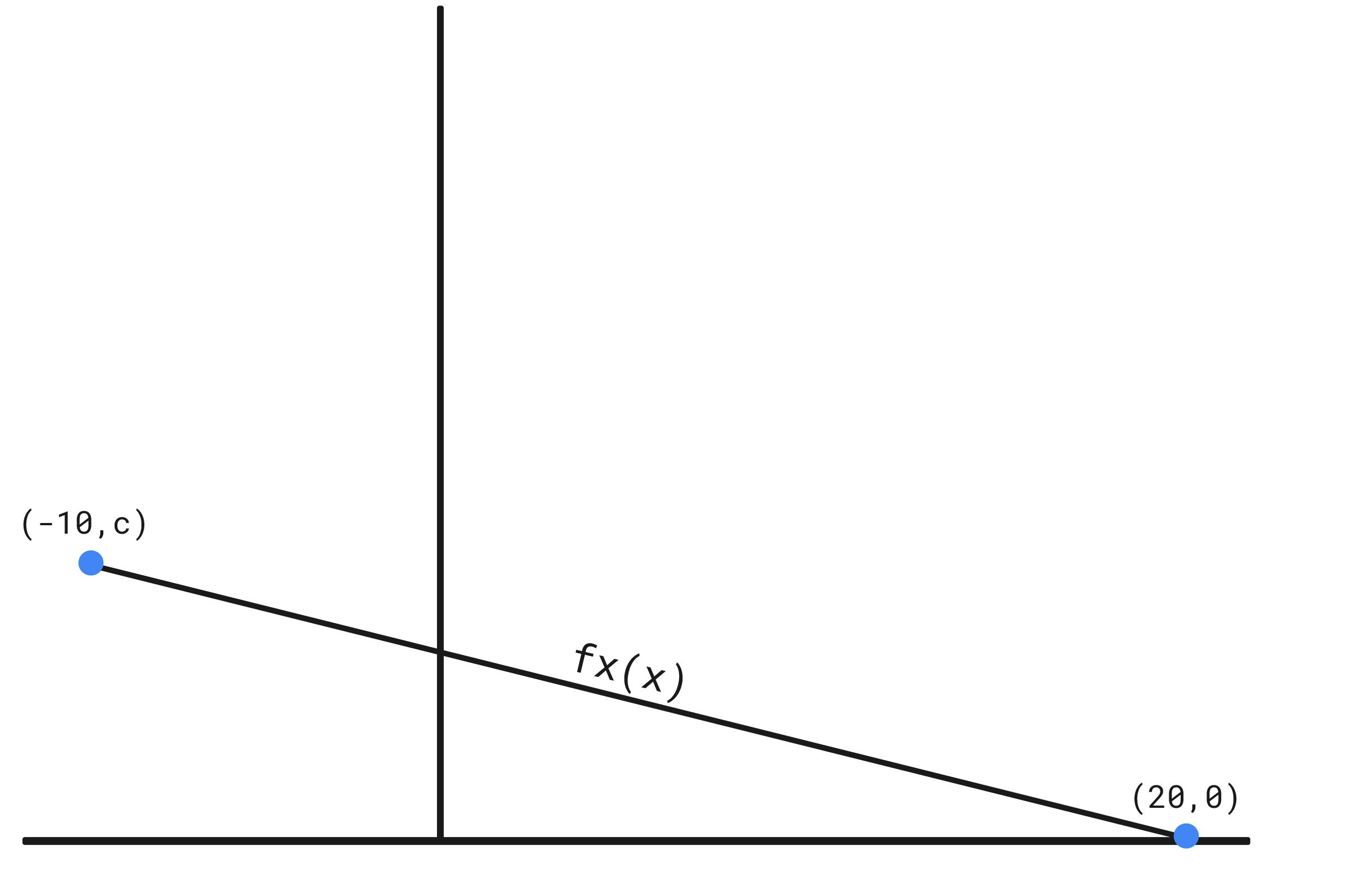
Since we know the function is only non-zero over [-10,20]: . Now that we know c we can define , therefore: . Given the definition we established in (a), and we are given that we can now calculate v:

* + 1. 

Based on the information we are given we know that c = 0.005569078782, , and the CDF =. Given the definition we established in (a), and we are given that we can now calculate v: .

* 1. I feel that the VaR is high sensitive as its value has varied greatly over the five PDFs examined. It is interesting to note however, how (b ii) and (b iii) are relatively close together, as is (c i) and (c ii), while (b i) is pretty much in the middle of the two groups.
     1. 

Since we know the function is only non-zero over [-10,20] we can define our uniform CDF as: . Now that we have our CDF we can calculate v: .

* + 1. 

Since we know the function is only non-zero over [-10,20]: . Now that we know c we can define , therefore: . Given the definition we established in (a), and we are given that we can now calculate v: .