Picking Distractors for Multiple Choice Questions

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Multiple choice questions are an appealing format for both instructors and students. In fact, some instructors prefer to use the multiple choice type for all their questions. However, formulating multiple choice questions is not simply a matter of typing one correct and a few incorrect answers.

Distractors are the incorrect answers in a multiple choice question. Choosing your distractors poorly can make your multiple choice questions much easier or harder than you may have intended.

Consider the following two questions.

1. Where does the graph of \( y = (x - 1)(x + 7)^2 \) cross the x-axis?
   (a) 1
   (b) 2
   (c) 3
   (d) 4
   (e) 5

2. Where does the graph of \( y = (x - 1)(x + 7)^2 \) cross the x-axis?
   (a) -7
   (b) -1
   (c) 0
   (d) 1
   (e) 7

If a student doesn’t know the answer to a question, their first instinct will be to look for something familiar from the question stem. In the first question, the only response that reflects anything they see in the stem is (a), and they will likely select that choice even if they don’t know the answer to the question being asked.

In the second question, simply looking for a value from the question will not allow the student to choose the correct response.
Selecting good distractors is the main ingredient in writing strong multiple choice questions. In this Tips and Techniques article, we provide some suggestions for picking distractors for multiple choice questions in Maple T.A.

**Distractors should highlight common student mistakes**

This is the most fundamental rule of creating multiple choice questions. It may sound obvious, but it is commonly overlooked: distractors should represent actual incorrect results you would expect students to produce.

Once again, consider the sample questions discussed above.

In addition to including various values taken from the question stem, the second question is a better test of the student’s knowledge because it includes distractors that represent errors the student is likely to make:

(a) -7 the student takes the intercept from the wrong factor, \( x + 7 \)
(b) -1 the student uses the correct factor, but makes a mistake with the sign
(c) 0 the student thinks that crossing any axis means \( x = 0 \)
(d) 1 the correct answer
(e) 7 the student uses the incorrect factor, and makes a mistake with the sign

**Only have one correct answer**

This sounds obvious too, but it’s all too easy to inadvertently create a multiple choice question with two or more answers that are technically correct. Sometimes rephrasing the question is all that’s necessary to correct the problem.

Whenever you include equivalent answers in various forms, you could run into trouble. If you want to force students to write an answer in a specific format, make sure you specify that in the question.

3. What is the slope of the tangent to the graph of \( y = 12\sqrt{x} \) when \( x = 2 \) ?

(a) \( \frac{3}{\sqrt{2}} \)
(b) \( 3\sqrt{2} \)
(c) \( \frac{6}{\sqrt{2}} \)
(d) \( 6\sqrt{2} \)
(e) \( 12\sqrt{2} \)
In this case, the instructor may intend for the student to rationalize the denominator, but if this is not specified then both (b) and (c) are correct answers.

Note: some researchers suggest using distractors that are true statements, but that do not answer the question asked. It is up to you whether you want to include this type of distractor.

**Avoid always/never and all/none of the above**

Students understand that very few statements are “always true” or “never true” without exception, so they are often wary of answers that use these words.

All/none of the above may seem like an enticing option, but if a student can identify a single choice as true, they know that “none of the above” isn’t the answer. Similarly, if they can identify a single choice as false, they can also eliminate “all of the above” for free. In many cases, a student can eliminate distractors and receive full marks on the question without actually knowing the correct answer.

All/none questions can often be replaced with something like the following:

4. Which of the following are factors of $x^4 - 256$?

   I. $x - 4$  
   II. $x + 4$  
   III. $x^2 + 16$

(a) I only  
(b) II only  
(c) III only  
(d) I and II  
(e) I, II and III

Note, however, that some researchers suggest avoiding questions of this type as they feel that these questions may emphasize test-taking skills over mathematical understanding.

**More general rules for writing distractors**

Here are a few more general rules for writing distractors.

- Distractors should be neither too similar nor too different. Without even looking at the question, if a student sees the list of answers triangle, square, circle, apple

  they will likely know that “apple” is not the correct answer. However, choices
should also not be so similar that students have trouble finding the differences between them.

- The correct answer shouldn’t be significantly simpler/shorter or significantly longer/more complex than the distractors, as this will single it out.

- Distractors should be grammatically consistent with the correct answer and with the question stem. In the following question, choice (b) was clearly added as an afterthought and does not match up with the question stem.

  When factoring, your first step should always be to
  (a) check for common factors.
  (b) dividing through by the \(x\)-coefficient.

- Choices should be mutually exclusive. The question below demonstrates how easy it is to break this rule.

  How many real solutions are there to the equation \((x + 1)(x + 2)(x + 3) = 0\) ?
  (a) more than 1
  (b) more than 2

- Distractors should be put in a logical order whenever such an order exists. For example, numeric answers should be listed in increasing or decreasing order.

- Four choices is often a good number, but it’s best to let the number of answer choices be determined by the number of reasonable distractors you can come up with. It is far better to have three well-designed alternatives than five poorly-designed ones.

**A quick way of generating distractors for math questions**

In a pinch, you can often create four-choice multiple choice mathematics questions as follows:

  a) correct answer
  b) common student error
  c) same as a) with a minus sign added/changed
  d) same as b) with a minus sign added/changed

Just make sure you don’t always follow the same pattern, or your students will pick up on it and guess the correct answer.