2 + 2 = 4 (?)
Note:

Students will be able to make up one (and only one) test from either Unit I or Unit II via a writing assignment. The student who wants to take advantage of this opportunity must schedule an appointment with me during office hours. We will then go through the student’s scantron to see which questions were answered incorrectly. Once we’ve figured this out, the assignment will be based on those questions.
A view that became popular in Philosophy is to view the truth not as an object, i.e., the whole truth or one big truth, but instead as a property. Truth (in this theory) is a property of sentences, or propositions.
Background Concepts

A proposition is the thought that is expressed by a sentence which can be either true or false, i.e., a declarative sentence.

E.g., “Snow is white.”
All propositions are truth-functional, i.e., they are either true or false.
E.g. of non-propositions:
“What’s a pizookie?”
“Please stop talking.”
“AHHHH!”
Under this way of thinking, all propositions need a truthmaker, i.e., something that makes the statement true.

E.g., “The cat is on the mat.”
Question:
What makes “2 + 2 = 4” true?
Do mathematical objects exist?
Kurt Gödel (1906-1978)
A complete survey of this debate (plus a whole lot more) can be found in Shapiro (2002).
Possible Positions

Physicalism is the view that:

a. mathematical objects exist, and
b. they are ultimately physical.

I.e., mathematical objects are just piles of physical stuff.
Pictures Addition With Sum to 10.

Count, sum and circle the correct number.

\[
\begin{align*}
\text{rose} + \text{roses} &= 234 \\
\text{plant} + \text{plant} &= 234 \\
\text{pencils} + \text{pen} &= 456 \\
\text{dancers} + \text{dancers} &= 789 \\
\text{chickens} + \text{chickens} &= 789 \\
\text{pears} + \text{pears} &= 456
\end{align*}
\]
Possible Positions

Conceptualism (a.k.a. psychologism) is the view that:

a. mathematical objects exist, and
b. they are ultimately mental objects.

I.e., mathematical objects are just ideas subjectively constructed in our minds.
Nominalism (+ fictionalism) (a.k.a. anti-realism) is the view that:

a. mathematical objects don’t exist;

b. mathematical propositions are strictly-speaking false.

Mathematical statements are technically false since numbers don’t exist, but are true in a weak sense, i.e. true in the fiction of mathematics.
Possible Positions

- Physicalism
- Conceptualism
- Nominalism (+ fictionalism)
Objections
There is an infinite amount of numbers, but there is not an infinite amount of physical stuff. That means there is not enough physical stuff to serve as a truthmaker for all mathematical objects. Physicalism must be false.
Possible Positions

- [x] Physicalism
- [ ] Conceptualism
- [ ] Nominalism (+ fictionalism)
Argument Against Conceptualism

The Subjectivity Problem
1. Conceptualism would make mathematical errors impossible.
Tanner, can you please state a prime number for me?
That's not a prime...

Maybe your 4 isn’t prime, but mine is...
The Subjectivity Problem

1. Conceptualism would make mathematical errors impossible.
2. But mathematical errors are possible.
3. So, conceptualism is false.
Solve by multiplying:

A. \[ \frac{31}{23} \times \frac{93}{20} = 520 \]

B. \[ \frac{90}{58} \times \frac{53}{20} = 4547 \]

C. \[ \frac{53}{20} \times \frac{53}{20} = 5267 \]

D. \[ \frac{71}{46} \times \frac{20}{8} = 5120 \]

E. \[ \frac{52}{44} \times \frac{3}{2} = 5348 \]

F. \[ \frac{32}{64} \times \frac{4}{2} = 5120 \]

Score: 15
Math Test

1. Bob has 36 candy bars. He eats 29. What does he have now?

Diabetes

Bob has diabetes.

2. Two trains left Kalamazoo, one heading north and the other heading south. The speed of the first train is 10 miles per hour greater than the second.
Possible Positions

- Physicalism
- Conceptualism
- Nominalism (+ fictionalism)
Fictionalism makes it so that propositions we know(?) are true, eg “2+2=4”, are strictly-speaking false, which is counterintuitive. Yet, some mathematicians accepted this result with the dawn of non-Euclidean geometries.

Argument Against Nominalism/Fictionalism
In 2001, the magazine Physics World ran a poll on the philosophical views of physicists. Among various questions, about the reality of electrons, genes, atoms, emotions, and lightwaves, the survey also asked about beliefs regarding numbers...

<table>
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<tr>
<th></th>
<th>Real</th>
<th>Not Real</th>
<th>Not Sure</th>
</tr>
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<tbody>
<tr>
<td>The Earth</td>
<td>93%</td>
<td>3%</td>
<td>4%</td>
</tr>
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<td>12%</td>
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<tr>
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<td>66%</td>
<td>26%</td>
<td>8%</td>
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<tr>
<td>Imaginary Numbers</td>
<td>43%</td>
<td>44%</td>
<td>13%</td>
</tr>
</tbody>
</table>
University of Texas historian of science and technology, Alberto Martinez, surveyed his students each semester from 2005 to 2010.

“Out of 245 majors in mathematics and the sciences over those five years, 77 percent of the students wrote that triangles existed before humans and will continue to exist forever.

Almost 22 percent disagreed, and only 3 students chose not to reply and wrote instead ‘maybe,’ ‘neither,’ or ‘no idea’” (Martinez 2012: xx).
INFORMAL FALLACY OF THE DAY
Argumentum Ad Populum

This is a fallacy in which an arguer lends support to his/her conclusion by claiming that a majority of people endorse the same conclusion.
Standard Form(?)

1. Most of the world agrees with me.
2. Therefore, I am right.
This fallacy is relevant here because the issue of how many physicists or mathematicians believe that numbers are real is orthogonal (or philosophically independent) of whether or not numbers really are real...
Shapiro (2002: 174) reminds us that the most common argument against logical intuitionists, who do not believe that mathematical objects exist (or make no assumption that they do), was that this approach “cripples the mathematician.” Surely, metaphysical speculation should not impede the practice of mathematics.
P ∨ ~P
“Science was born of faith in the mathematical interpretation of Nature, held long before it had been empirically verified” (Randall 1976: 235).

In other words, the great success of the natural sciences today was not yet empirically validated in the 17th century.

It was a time of intellectual and social upheaval...
Possible Positions

- Physicalism
- Conceptualism
- Nominalism (+ fictionalism)
For a powerful formal development of nominalism, see Field (2016).
There is another view...
Possible Positions

Some argue that:

a. mathematical objects exist;
b. they are non-physical, abstract objects that exist independently of the mind.

We can access these abstract objects through the use of reason.
Kurt Gödel (1906-1978)
This view is called **Platonism** since it’s the view of Plato...