

REAL-WORLD TAKEAWAYS

- Humans have been making technological innovations throughout history – in communication, in travel, in warfare. Over time, advancements from one milestone to the next have come more and more quickly.
- Future innovations – like those of the past – will likely offer convenience and meaningful enhancements to our lives; they may also come with serious dangers. It's important for society to anticipate, consider, and discuss these impending risks.

MATHEMATICAL OBJECTIVES

- Model “before zero” years using negative integers
- Order and position positive and negative integers on a number line
- Find the difference between integers, including negatives

LESSON AT A GLANCE
90 MIN.

		LESSON AT A GLANCE	90 MIN.
LAUNCH		Watch a 2007 commercial for the first iPhone. Identify innovations that have been significant in this lifetime and across human history.	5 min.
PART ONE	1	Order milestones in three categories – communication, travel, warfare – from earliest to latest.	15 min.
	2	For one of the categories, arrange the milestones on a number line. Notice that significant leaps happen more quickly as time passes.	25 min.
PART TWO	3	Determine the time difference between various sets of milestones, including differences between BCE and BCE years, CE and CE years (also called “AD”), and BCE and CE years.	30 min.
	4	Watch a video mash-up about three innovations we may see in the future: auto-translation programs, self-driving cars, and robot soldiers. Discuss potential implications for humanity.	15 min.

- L Students watch a commercial for the first-ever iPhone (2007). This may seem like familiar technology today, but when it came out a little more than a decade ago people described it as “revolutionary.”

DISCUSSION QUESTIONS

1. Do you know when the first iPhone came out? If you remember it, did you think it was a big deal?
2. What has been the most exciting or transformative innovation in your lifetime (in transportation, communication, etc.)?
3. What have been some of the most important innovations in human history...and when do you think they occurred?

KEY TAKEAWAYS

- Humans have been innovating for thousands and thousands of years and in many different areas.
- What seems revolutionary today might seem normal (even boring) tomorrow.

- 1 Throughout history, humans have made significant advancements in how we communicate, how we travel, and how we fight. Cut out the milestones on the last page of the handout and rearrange them in chronological order.

Within each category, which milestone do you think felt the most “revolutionary” at the time and why?

COMMUNICATION

Spoken Language		200,000 BCE
Cave Paintings		30,000 BCE
Hieroglyphics		5,000 BCE
Alphabet		1,700 BCE
Paper		100
Printing Press		1439
Telegraph		1840
Telephone		1876
Television		1909
FM Radio		1933
Email		1971
Mobile Phone		1973
World Wide Web		1989
Text Message		1992
iPhone		2007
Oculus (VR)		2013

TRANSPORTATION

Canoe		8,000 BCE
Animal Sledge		7,000 BCE
Wheeled Cart		3,500 BCE
Chariot		1,800 BCE
Galley		1,500 BCE
Sailing Junk		200
Stage Coach		1550
Hot Air Balloon		1783
Steamboat		1785
Steam Train		1804
Gasoline Car		1886
Airplane		1903
Jetliner		1952
Spacecraft		1961
Maglev Train		1984
Self-Driving Car		2009

WARFARE

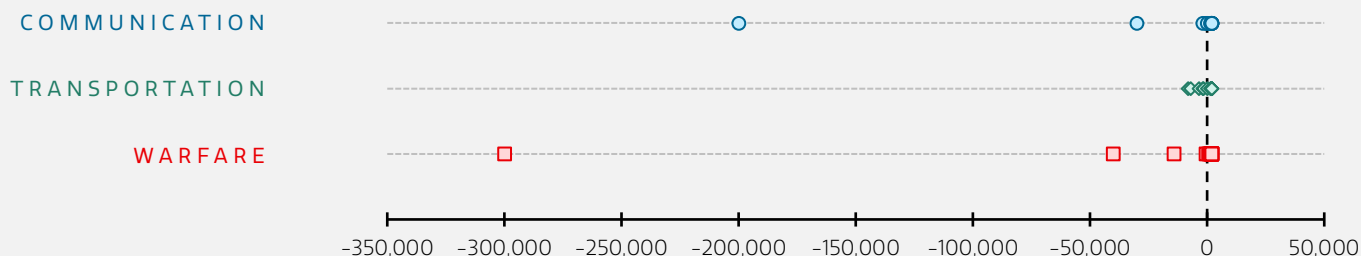
Spear		300,000 BCE
Bow & Arrow		40,000 BCE
Iron Sword		14,000 BCE
Catapult		400 BCE
Gunpowder		800
Cannon		1326
Musket		1475
Grooved Rifle		1800
Machine Gun		1861
Fighter Plane		1915
Tank		1916
Missile		1939
Jet Fighter		1941
Atomic Bomb		1945
Drone		2002
Cyberwar		2010

Responses will vary about which innovation students consider the most “revolutionary.”

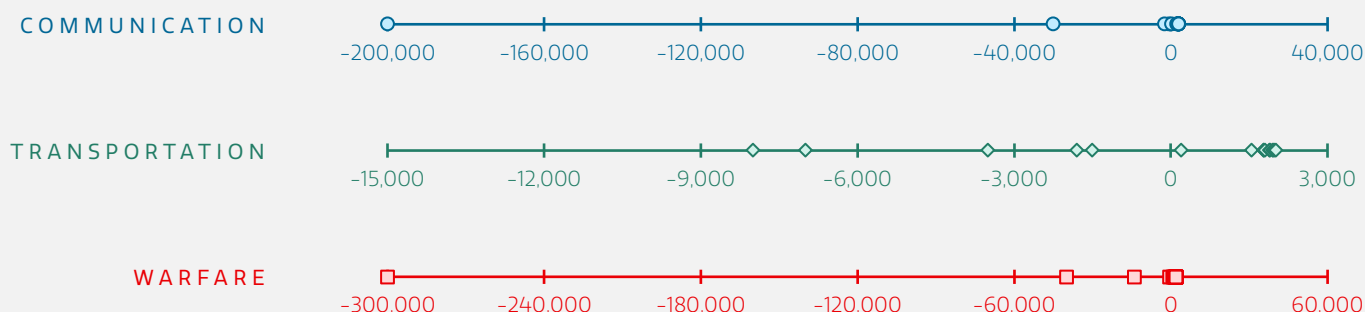
- 2 Using string, tape, or some other material, create a number line to represent a timeline of human history. Then choose a category – **communication**, **transportation**, or **warfare** – and position the milestones as accurately as you can. (If it’s helpful, you can use negative numbers to represent “BCE” years, where $-200,000 = 200,000$ BCE.)

What do you notice about how many years it took for humans to advance from one milestone to the next? Are you surprised by this?

METHOD 1: ALL CATEGORIES ON SAME TIMELINE



METHOD 2: EACH CATEGORY ON OWN TIMELINE



In each category, it initially took a long time to advance from one milestone to the next. But as time passed, the time between milestones got shorter and shorter. On the number lines, you can see large gaps between the early milestones, but in more recent years the milestones become clustered together; they happen so quickly after one another that you can’t even tell them apart.

TEACHING TIP

The longer students can make the line, the more accurately they’ll be able to place the milestone labels. Consider placing a piece of tape on the floor of the hallway outside your classroom or, if possible, even going to the football field.

Even though the timelines above include year 0, in reality there is no such thing; the calendar goes directly from 1 BCE (-1) to 1 CE (+1), skipping 0. However, we recommend ignoring this detail and including year 0. This will make it easier to calculate the number of years that passed between a BCE date and an CE date. Since the numbers are so large, the “extra year” won’t make a difference practically.

- 3 The following diagrams show innovations in **communication**, **transportation**, and **warfare**. Calculate how many years it took for humans to advance between each innovation. (In the fourth diagram, choose a category – communication, transportation, or warfare – and pick your own three innovations. Try to pick ones which you think tell the most interesting story about how technology has advanced.)

METHOD 1: USE "NICE" INTERMEDIATE NUMBERS (FORWARDS)

Start at 200,000 BCE.

Go to 100,000 BCE (+100,000 years),
then to 2,000 BCE (+98,000 years),
then to 1,700 BCE (+300 years).



200,000 BCE

$$100,000 + 98,000 + 300 =$$

198,300 years

70

1,700 BCE

Start at 1,700 BCE.

Go to year 0 (+1700 years),
then to 1900 (+1900 years),
then to 1971 (+71 years).

$$1,700 + 1900 + 71 =$$

3,671 years



1971

METHOD 2: USE "NICE" INTERMEDIATE NUMBERS (BACKWARDS)

Start at 1550.

Go to year 0 (–1550 years),
then to 1,000 BCE (–1000 years),
then to 1,800 BCE (–800 years).



1,800 BCE

$$-(1550 + 1000 + 800) =$$

–3,350 years



1550

Start at 2009.

Go to 2000 (–9 years),
then to 1600 (–400 years),
then to 1550 (–50 years).

$$-(9 + 400 + 50) =$$

–459 years



2009

METHOD 3: REASON ABOUT SUBTRACTING BCE FROM BCE, BCE FROM CE

–40,000 – (–300,000) is the same
“distance” as 300,000 – 40,000.



300,000 BCE

$$260,000 \text{ years}$$



40,000 BCE

1,945 – (–40,000) is the same
“distance” as 40,000 + 1,945.

$$41,945 \text{ years}$$



1945

METHOD 4: USE SUBTRACTION ALGORITHM

$$\begin{aligned} -1,800 - (-7,000) &= \\ 7,000 - 1,800 &= \\ \underline{5,200 \text{ years}} \end{aligned}$$



7000 BCE



1800 BCE

$$\begin{aligned} 1,886 - (-1,800) &= \\ 1,800 + 1,886 &= \\ \underline{3,686 \text{ years}} \end{aligned}$$



1886

- 4 Some people think *new* is the same as *better*, while others argue that technology is changing faster than humans can keep up. Watch the video about three innovations we might see in the future.

What do you think about the pace of innovation, and what might be some consequences – both good and bad – for humanity?

Sample response:

The video shows three possible innovations: auto-translation programs that allow people who speak different languages to communicate with one another in real-time, the same way they would on a telephone; self-driving cars that actually operate on roads and highways; and remote-controlled (or even autonomous) robot soldiers. Considering that it's only been a few hundred thousand years since we even began to communicate, travel, and fight, humans seem to be innovating very quickly.

On one hand, this is great; being able to easily communicate with people in other countries could help us learn about new cultures, share ideas, etc. On the other hand, it's possible that we're creating new technologies faster than we can keep up with them. For instance, what happens if the robot soldiers decide to attack us, and the Army isn't able to disable them? While some of the innovations are helpful, others may be incredibly dangerous.