



THE 45 MINUTES

5 min
HOOK

12 min
TEACH

22 min
ACTIVITY

6 min
CLOSE

BY THE END OF THIS LESSON

You will be able to:

- 1 find the span of years between two dates: both AD, both BC, or across the join
- 2 explain why there is no year zero, and why a span from b BC to a AD is $a + b - 1$ years
- 3 use a ratio and a percent to explain why the widow's two small coins were more than all the others gave
- 4 **GO DEEPER** prove the no-year-zero rule with algebra

WHY THIS MATTERS Every date and amount on a coin is a number with a meaning. Reading it right means remembering there is no year zero, and asking what a number is a share of.

LEARNING OBJECTIVE

What students will be able to do

Students will use the numbers on the eleven coins of *In Their Hands* to find spans of years on a BC/AD timeline, using the rule that there is no year zero; place dates on a number line, using negative numbers as a model; compare measured coins in grams and millimeters; work with the ratio of a half-shekel to a shekel; and explain, as a fraction of all she had, why Jesus said the widow's two small coins were more than all the others gave.

STANDARDS

- **The number system** — positive and negative numbers on a number line; ordering; distance between two numbers (6.NS.C.5-7, 7.NS.A.1)
- **Ratios and proportional reasoning** — ratio language; percent as a rate per 100 (6.RP.A.1, 6.RP.A.3c, 7.RP.A.3)
- **Expressions and equations** — writing and solving one-step equations; expressions with variables (6.EE.A.2, 6.EE.B.7, 7.EE.B.4)
- **Measurement** — decimals in grams and millimeters; scale on a timeline (6.NS.B.3, 7.G.A.1)

MATERIALS NEEDED

- A strip of tape on the board for a class timeline; centimeter rulers (Red level)
- The Pilate prutah card on the handouts, or the coin on the exhibition page
- Differentiated handouts, one per student; the answer key is page 3

CROSS-CURRICULAR AND ASSESSMENT NOTES

Religion: Mark 12:41-44, giving from poverty rather than surplus. **Social Studies:** who governed Judaea when. **Assessment:** the handout, the exit ticket, and at Red the written explanation in Part 4.

HOOK · 5 MINUTES

What year came before AD 1?

Ask: “If this is AD 1, what year came just before it?” Most students say year zero.

Draw the line below and tell them there was none: the years are counted from one, so 1 BC is followed straight away by AD 1. Then ask how long the Shekel of Tyre’s dates, 1 BC to AD 1, really span. One year — not two.



DIRECT INSTRUCTION · 12 MINUTES

Three kinds of span

Both dates AD. Subtract as usual. Claudius reigned from AD 41 to 54: $54 - 41 = 13$ years.

Both dates BC. BC numbers count *down* toward the join, so the earlier date is the bigger number. Herod the Great ruled from 37 BC until his death in 4 BC: $37 - 4 = 33$ years.

Across the join. Add, then take away one, because there is no year zero: hop from 2 BC to AD 2 and count three hops, not four. Work Augustus together (below).

The model and its flaw. Treat BC years as negative numbers: 27 BC sits at -27 , AD 14 at $+14$. The distance from -27 to 14 is 41 : one too many, because a number line has a zero and the calendar does not.

Two more strands. Every Jewish man over twenty owed a half-shekel Temple tax each year: a ratio of $1 : 2$, so in Matthew 17:27 one coin worth a shekel pays for Jesus and Peter. And the widow gave two lepta, *everything* she had: 2 out of 2 is 100%.

WORKED EXAMPLE

How long did Augustus rule?

1. Augustus ruled from **27 BC** until his death in **AD 14**.
2. Count back from 27 BC to the join: 27 years. Count on from the join to AD 14: 14 years. $27 + 14 = 41$.
3. The dates cross from BC to AD, and there is no year zero to stand on, so take away one: $41 - 1 = 40$ years.

ACTIVITY · 22 MINUTES

Students choose a handout. All three use the same coins and dates.

GREEN LEVEL MORE SUPPORT

A worked example, then guided spans: AD dates, BC dates, and dates across the join. Place five coins on a number line. Find the widow’s gift as a fraction and a percent, and the Temple tax for a group of men.

YELLOW LEVEL GRADE LEVEL

Mixed problems: the no-year-zero rule, a table of six spans to rank, Pilate’s coin and the regnal year of Tiberius, the two measured coins, thirty shekels and the Temple tax, and three givers compared by amount and by percent.

RED LEVEL GO DEEPER

Prove the no-year-zero rule with algebra, solve multi-step date problems, build a timeline to scale from 103 BC to AD 62, and use an equation to compare the widow’s gift with a large gift that is a small fraction of great wealth.

CLOSE · 6 MINUTES

Exit ticket

1. How many years from 4 BC to AD 39, the dates on the coin of Herod Antipas? (42.) 2. The widow gave the least money. In what mathematical sense did she give the most? (The largest share of what she had: 100%.)

Put the objectives back on the screen, asked as questions: “Can you now...?” For each one, students show a thumb up, sideways or down. Ask one student to answer each aloud; for the last, ask a Red Level reader.

MINI MUSEUM CONNECTION

Visit the exhibition: the Gospel Timeline walks the eleven coins in date order, from the census under Augustus to Paul’s appeal before Festus; students can check each span as they go. In Case 7, find the widow’s two lepta and Pilate’s prutah, 1.79 g and 16 mm.

minimuseumproject.org/exhibitions/in-their-hands

ANSWER KEY

Answers with working

The rule. From b BC to a AD is $a + b - 1$ years; from 1 BC to AD 1 is one year. A number line measures from zero; the calendar counts from one, so the BC years model as negatives with a missing zero. **Approximate dates.** Claudius' edict (about AD 49), Festus' arrival (about AD 59) and the widow's gift (about AD 30) are approximate, and so are answers built on them. Pilate's coin is AD 29/30 because year 16 of Tiberius ran across two calendar years. **Invented numbers.** The exhibition gives no ancient prices, wealth or exchange rates. Every wealth figure in the widow problems is invented for the math, and the handouts say so.

GREEN LEVEL

Part 1 · No year zero

- 3 BC $\rightarrow$ 2 BC $\rightarrow$ 1 BC $\rightarrow$ AD 1 $\rightarrow$ AD 2 $\rightarrow$ AD 3: **5 hops, 5 years.**
Check: $3 + 3 - 1 = 5$.

Part 2 · Six spans of years

- Tiberius, AD 14–37: $37 - 14 = \mathbf{23}$
- Pilate, AD 26–36: $36 - 26 = \mathbf{10}$
- Herod the Great, 37–4 BC: $37 - 4 = \mathbf{33}$
- Claudius, AD 41–54: $54 - 41 = \mathbf{13}$
- Aretas IV, 9 BC–AD 40: $9 + 40 = 49$; $49 - 1 = \mathbf{48}$
- Herod Antipas, 4 BC–AD 39: $4 + 39 = 43$; $43 - 1 = \mathbf{42}$
- Longest: **Aretas IV** (48 years)

Part 3 · Coins in order

- Left to right: **A** 103 BC, **B** 37 BC, **C** 5 BC, **D** AD 29, **E** AD 59.
Earliest: **A**, the widow's mite.

Part 4 · Two small coins

- Widow: $2/2 = \mathbf{1}$, **100%**. Invented giver: $10/100 = \mathbf{1/10}$, **10%**.
- Larger share: **the widow**

Part 5 · Half a shekel

- $4 \times \frac{1}{2} = \mathbf{2}$ **shekels**; $10 \times \frac{1}{2} = \mathbf{5}$ **shekels**

YELLOW LEVEL

Part 1 · The rule

- 1 BC to AD 1: $1 + 1 - 1 = \mathbf{1}$ **year**. Not 2, because there is no year zero between them.

Part 2 · Spans

- Augustus 27 BC–AD 14: $27 + 14 - 1 = \mathbf{40}$
- Herod the Great 37–4 BC: $37 - 4 = \mathbf{33}$
- Aretas IV 9 BC–AD 40: $9 + 40 - 1 = \mathbf{48}$
- Herod Antipas 4 BC–AD 39: $4 + 39 - 1 = \mathbf{42}$
- Herod Agrippa I AD 41–44: $44 - 41 = \mathbf{3}$
- Claudius AD 41–54: $54 - 41 = \mathbf{13}$
- Longest to shortest: **Aretas, Antipas, Augustus, Herod the Great, Claudius, Agrippa**

Part 3 · Pilate's coin

- Year 1 began in AD 14, so year 16 began 15 years later: $14 + 15 = \mathbf{AD\ 29}$, running into AD 30 — hence 29/30.
- Pilate arrived AD 26; coin AD 29: $29 - 26 = \mathbf{3}$ **years**.

Part 4 · Grams and millimeters

- Agrippa's: $1.80 - 1.79 = \mathbf{0.01\ g}$ heavier (10 mg)
- Together: $1.79 + 1.80 = \mathbf{3.59\ g}$
- $300\ \text{mm} \div 16\ \text{mm} = 18.75$, so **18 whole coins**
- Claudius AE27 is 27 mm: $27 - 16 = \mathbf{11\ mm}$ wider

Part 5 · Shekels

- Half-shekel : shekel = **1 : 2**
- $30 \div \frac{1}{2} = 30 \times 2 = \mathbf{60}$ **men** for one year

Part 6 · Three givers (invented numbers)

- A: $40/400 = \mathbf{10\%}$; B: $25/50 = \mathbf{50\%}$; widow: $2/2 = \mathbf{100\%}$
- By amount: A (40), B (25), widow (2). By percent: widow, B, A — the order reverses.

RED LEVEL

Part 1 · Prove the rule

- Relabeled, b BC is $1 - b$. Distance: $a - (1 - b) = \mathbf{a + b - 1}$. 1 BC $\rightarrow$ 0, AD 1 $\rightarrow$ 1: 1 year ✓
- $27\ \text{BC} \rightarrow 1 - 27 = \mathbf{-26}$; $14 - (-26) = \mathbf{40}$ ✓

Part 2 · Multi-step

- Herod dies 4 BC; Agrippa king AD 41: $4 + 41 - 1 = \mathbf{44}$ **years**
- Last lepton minted 76 BC; still in use about AD 30: $76 + 30 - 1 = \mathbf{105}$ **years** — over a century ✓. From 103 BC: $103 + 30 - 1 = \mathbf{132}$.
- AD 30 to 1961: **1,931 years** (1,932 from AD 29)

Part 3 · Timeline to scale (1 cm = 10 years)

- a. 103 BC to AD 62: $103 + 62 - 1 = 164$ years $\rightarrow \mathbf{16.4\ cm}$
- b. 1 BC to AD 1 is one year: **0.1 cm = 1 mm**
- c. From the start: 27 BC (76 years) **7.6 cm**; 1 BC (102) **10.2 cm**; AD 1 (103) **10.3 cm**; AD 29 (131) **13.1 cm**; AD 62 (164) **16.4 cm**
- d. $164 \div 15 \approx 10.9$, so **11 years per cm** ($164 \div 11 \approx 14.9$ cm; 10 gives 16.4 cm, too long)

Part 4 · The widow's gift (invented numbers)

- $0.05W = 600 \rightarrow W = 600 \div 0.05 = \mathbf{12,000}$ **lepta**
- He keeps $12,000 - 600 = \mathbf{11,400}$; she keeps **0**
- Amount: $600 \div 2 = \mathbf{300}$ **times** hers. Fraction: $100\% \div 5\% =$ hers is **20 times** his.
- Kept: $W - G$, or $W(1 - f)$; widow $f = 1 \rightarrow 0$