Graphing the Cosine Function

Name: _____	Date: _____	Score: _____ / 36

Quick Review

Cosine is sine's twin – same shape, same range, same period, just shifted. Where sine starts at $(0, 0)$ and climbs, cosine starts at the top: $(0, 1)$. Plot $y = \cos x$ and you get a wave that begins at a crest and rolls forever.

The five anchor points of one cycle. Start at $(0, 1)$, drop to zero at $\left(\frac{\pi}{2}, 0\right)$, hit the bottom at $(\pi, -1)$, climb back to zero at $\left(\frac{3\pi}{2}, 0\right)$, and return to the top at $(2\pi, 1)$.

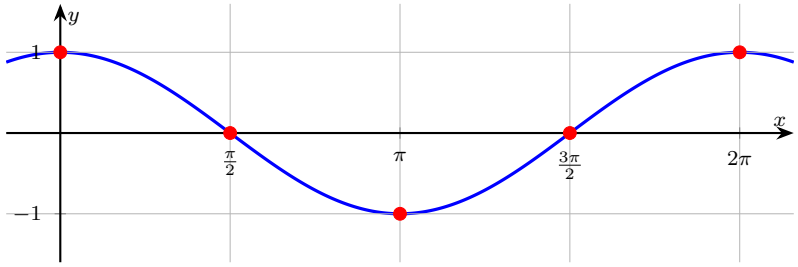
Key facts. Domain: $\mathbb{R}$. Range: $[-1, 1]$. Period: 2π. Amplitude: 1. Zeros: $x = \frac{\pi}{2} + n\pi$ (every half-period from $\frac{\pi}{2}$). Symmetry: about the y-axis – cosine is *even*, $\cos(-x) = \cos x$.

Sine vs. cosine in one line. They are the same curve shifted by $\frac{\pi}{2}$: $\cos x = \sin\left(x + \frac{\pi}{2}\right)$. That single fact unlocks half the problems in this chapter.

Transformation read. In $y = a\cos(bx)$ the amplitude is $|a|$ and the period is $\frac{2\pi}{|b|}$. A negative a reflects the graph across the x-axis – the wave now starts at the bottom $(0, -|a|)$ instead of the top.

Common slips. Confusing the cosine zero ($x = \frac{\pi}{2}$) with the sine maximum – they happen at the same x, which is why students mix them up. Forgetting that cosine *starts* at the top, so the y-intercept is 1 (not 0). Calling cosine odd – it's even.

Here's the parent cosine wave from 0 to 2π:



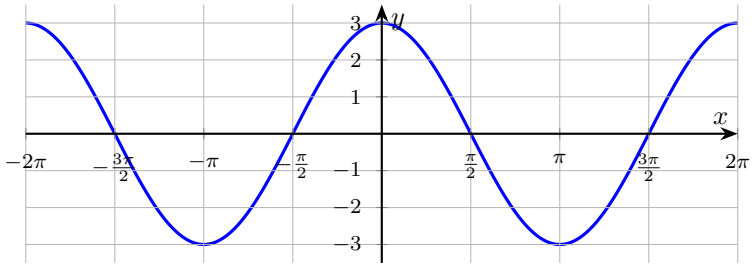
PRACTICE

Read amplitude, period, and intercepts from each cosine graph. Sketch when asked.

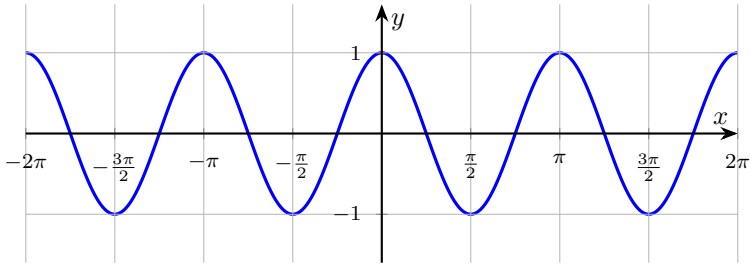
1. State the amplitude and period of $y = \cos x$. _____
2. State the amplitude and period of $y = 4\cos(3x)$. _____
3. What is the y-intercept of $y = \cos x$? _____
4. Where does $\cos x$ reach its maximum on $[0, 2\pi]$? _____
5. At which values of x does $\cos x = 0$? _____
6. How does the graph of $y = -\cos x$ compare to $y = \cos x$? _____
7. What is the range of $y = \cos x$? _____
8. Evaluate $\cos\left(\frac{\pi}{2}\right)$. _____
9. Evaluate $\cos(\pi)$. _____
10. $y = \cos x$ is symmetric about which feature? _____

Scan Me

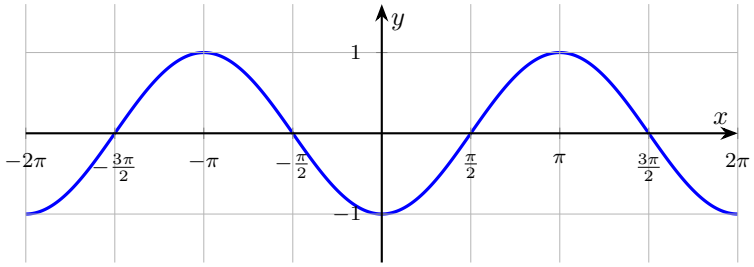
11. Identify the amplitude and period from the graph below. _____



12. Identify the period from the graph below. _____



13. Identify the amplitude from the graph below. _____



14. Write the equation of a cosine function with amplitude 2 and period 4π, no shifts. _____

15. State the domain and range of $y = \cos x$. _____

16. Evaluate $\cos(2\pi)$. _____

17. At what x does $\cos x$ first reach its minimum on $[0, 2\pi]$? _____

18. True or false: $\cos x$ and $\sin x$ have the same period. _____

19. How many complete cycles of $y = \cos(2x)$ appear on $[0, 2\pi]$? _____

20. Evaluate $\cos\left(-\frac{\pi}{3}\right)$. _____

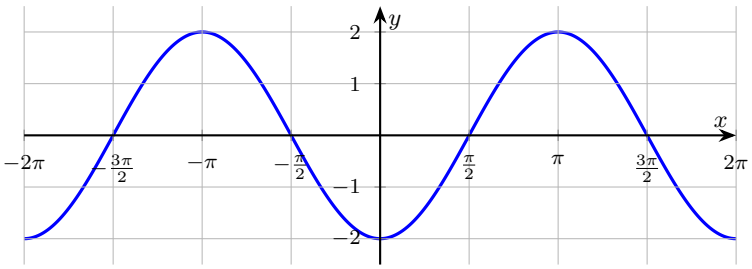
Scan Me

Word Problems

21. A daily-temperature model is $T(t) = 10\cos t + 70$, where T is in degrees Fahrenheit and t is in radians (with $t = 0$ at the warmest moment). State the amplitude, period, and the minimum temperature. ____

22. A pendulum's horizontal position is $x(t) = 0.4\cos(2t)$ meters. How far does the pendulum swing from center, and how long does one full back-and-forth take? ____

23. The graph below shows a transformation of the cosine function. Find the amplitude, period, and equation. _____



24. A wheel of radius 1 meter rolls without slipping. The horizontal position of a marker on its rim relative to the wheel's center is $x(\theta) = \cos\theta$. At which angle (in $[0, 2\pi]$) is the marker farthest to the left, and how far left is it? ____

Additional Practice

25. Amplitude of $y = 4\sin x$. _____

26. Period of $y = \sin(2x)$. _____

27. Amplitude of $y = -3\cos x$. _____

28. Period of $y = \tan(5x)$. _____

29. Midline of $y = 2\sin x - 7$. _____

30. Phase shift of $y = \sin(x - \pi/3)$. _____

31. Range of $y = 5\cos x$. _____

32. Range of $y = 2\sin x + 1$. _____

33. Asymptotes of $y = \tan x$ in one period. _____

34. Domain of $y = \sec x$ excludes what? _____

35. Range of $y = \csc x$. _____

36. Range of $y = \arcsin x$. _____

Scan Me

Answer Keys

1. amplitude 1, period 2π
2. amplitude 4, period $\frac{2\pi}{3}$
3. 1
4. $x = 0$ and $x = 2\pi$
5. $x = \frac{\pi}{2} + n\pi,\ n \in \mathbb{Z}$
6. reflected across the x-axis
7. $[-1,\ 1]$
8. 0
9. -1
10. the y-axis
11. amplitude 3, period 2π
12. π
13. 1
14. $y = 2\cos\left(\frac{x}{2}\right)$
15. domain $\mathbb{R}$, range $[-1, 1]$
16. 1
17. $x = \pi$
18. True
19. 2
20. $\frac{1}{2}$
21. amplitude 10, period 2π, $\min = 60°\text{F}$
22. 0.4 m; π s
23. amplitude 2, period 2π, $y = -2\cos x$
24. $\theta = \pi;\ -1$ m

Additional Practice Answers

25. 4
26. π
27. 3
28. $\frac{\pi}{5}$
29. $y = -7$
30. $\frac{\pi}{3}$ right
31. $[-5, 5]$
32. $[-1, 3]$
33. $x = \pm\frac{\pi}{2}$
34. $\cos x = 0$
35. $(-\infty, -1] \cup [1, \infty)$
36. $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$

Additional Practice: Answers for all numbered items, including the added practice, are shown in the grid above.

Step-by-Step Explanations

1. The parent cosine wave swings 1 unit above and below the midline and finishes a full cycle every 2π.

2. Match $y = a\cos(bx)$: $a = 4$, $b = 3$. Amplitude is $|a| = 4$, so the wave reaches 4 above and below the midline. Period is $\frac{2\pi}{|b|} = \frac{2\pi}{3}$ – always divide 2π by b, so the graph fits three full cycles in the usual 2π.

3. One steady path is: Plug $x = 0$: $\cos(0) = 1$. Cosine starts at the top. This is the part to check before moving on, because it keeps the answer tied to the original question.

4. Cosine hits its max of 1 at the start and end of one cycle. In general, $x = 2n\pi$.

5. Cosine is the x-coordinate on the unit circle; x-coordinate is zero at the top and bottom of the circle, which is $\frac{\pi}{2} + n\pi$.

6. The negative sign sends each output to its opposite. The new wave starts at the bottom: $(0, -1)$.

7. Same as sine – cosine is the x-coordinate on the unit circle, which lives in $[-1, 1]$.

8. Start with the key idea: At $\frac{\pi}{2}$, the unit-circle point is $(0, 1)$. Cosine reads the x-coordinate: 0. That gives a quick check on the answer.

9. A careful way to see it: At π, the unit-circle point is $(-1, 0)$, so $\cos\pi = -1$. This is the part to check before moving on, because it keeps the answer tied to the original question.

10. Keep the rule visible: Cosine is even: $\cos(-x) = \cos x$. That gives mirror symmetry across the y-axis. That gives a quick check on the answer.

11. The wave reaches 3 at the peak and -3 at the trough. It starts at $(0, 3)$ and returns at $(2\pi, 3)$, so the period is 2π. The equation is $y = 3\cos x$.

12. The cosine starts at the top, dips, and returns to the top after only π units. Period $= \pi$, equation $y = \cos(2x)$.

13. The wave maxes at 1 and mins at -1, so amplitude $= 1$. It starts at the bottom $(0, -1)$, so the equation is $y = -\cos x$ – the parent cosine flipped across the x-axis.

14. Amplitude 2 gives $a = 2$. For the period, set $\frac{2\pi}{b} = 4\pi$ and solve: $b = \frac{2\pi}{4\pi} = \frac{1}{2}$. No shifts, so $y = 2\cos\left(\frac{x}{2}\right)$; the small b stretches the wave to twice the usual width.

15. Every angle has a cosine (domain all reals), and the outputs are the x-coordinates on the unit circle.

16. Start with the key idea: 2π is one full lap – back to the start. $\cos(2\pi) = \cos(0) = 1$. This is the part to check before moving on, because it keeps the answer tied to the original question.

17. A careful way to see it: The minimum is -1, hit at the leftmost point of the circle: $x = \pi$. That gives a quick check on the answer.

18. Keep the rule visible: Both have period 2π. Cosine is just sine shifted left by $\frac{\pi}{2}$. That gives a quick check on the answer.

19. Here $b = 2$, so the period is $\frac{2\pi}{|b|} = \frac{2\pi}{2} = \pi$. The interval $[0, 2\pi]$ has length 2π, and $\frac{2\pi}{\pi} = 2$, so exactly two full cycles fit.

20. Start with the key idea: Cosine is even: $\cos\left(-\frac{\pi}{3}\right) = \cos\left(\frac{\pi}{3}\right) = \frac{1}{2}$. This is the part to check before moving on, because it keeps the answer tied to the original question.

21. Match against $y = a\cos(bt) + d$: $a = 10$, $b = 1$, $d = 70$. Amplitude is $|a| = 10$ and period is $\frac{2\pi}{|b|} = 2\pi$. The minimum sits one amplitude below the midline: $d - |a| = 70 - 10 = 60°\text{F}$.

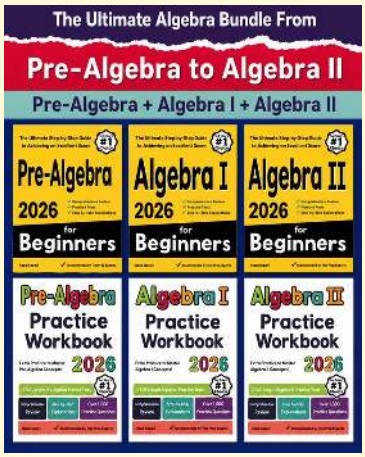
22. Amplitude $= 0.4$, so the pendulum swings 0.4 m either side of center. Period $= \frac{2\pi}{2} = \pi$ seconds, the time for one complete swing.

23. The wave starts at $(0, -2)$ – a reflected cosine – and reaches $+2$ at the trough turned upside down (which is $x = \pi$). So amplitude $= 2$ and the leading sign is negative. Period is the standard 2π. Equation: $y = -2\cos x$.

24. Start with the key idea: $\cos\theta$ hits its minimum of -1 at $\theta = \pi$. The marker is then 1 meter to the left of the wheel's center. That gives a quick check on the answer.

Scan Me

Build Algebra Confidence From Pre-Algebra Through Algebra II



The Complete Algebra Success Bundle

Pre-Algebra, Algebra I, and Algebra II in one clear path

Friendly lessons, focused practice, and full-review support for every stage.

Scan Me

Scan for the Bundle

6 Books
3 Courses
1 Path

Bundle Value: Six coordinated books help students review missing skills, learn new algebra topics, and practice until the steps feel natural.

Complete Course Path

- ✓ Starts with Pre-Algebra foundations
- ✓ Moves smoothly into Algebra I skills
- ✓ Extends learning through Algebra II topics
- ✓ Great for review, tutoring, and summer study

One bundle, one steady path.

Step-by-Step Lessons

- ✓ Plain-English explanations students can follow
- ✓ Worked examples that show every important step
- ✓ Common mistakes called out before they stick
- ✓ Skill-building practice after each lesson
- ✓ Helpful for independent study or class support

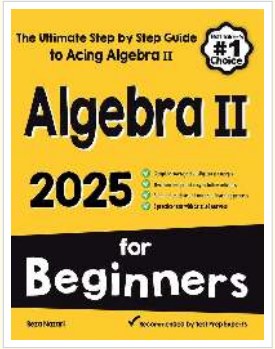
Less guessing. More understanding.

Practice That Sticks

- ✓ Matching practice workbooks for extra repetition
- ✓ Review sets to keep older skills fresh
- ✓ Answer explanations for checking thinking
- ✓ Strong support before tests and final exams
- ✓ Designed to build fluency and confidence

Practice today. Remember tomorrow.

STUDENT FAVORITE • Master Algebra II From the Ground Up



✓ 100% Guaranteed
✓ Lifetime Support
✓ Trusted by Teachers

Start Your Algebra Journey Today! →

Algebra II for Beginners

Written by a top math teacher & aligned with national and state Algebra II courses. From polynomial functions to logarithms, trigonometry, and rational expressions — explained the easy way.

- ✓ **Complete coverage** of every Algebra II concept — perfect companion to these worksheets
- ✓ **Step-by-step explanations** with worked examples on every topic
- ✓ **QR codes in every chapter** for free video lessons & bonus practice
- ✓ **2 full-length practice tests** with detailed answer keys

★ STUDENT'S #1 CHOICE ★

Teacher-recommended • 12,000+ Happy Students

↓ PDF EDITION

Scan Me

Instant download • any device

PAPERBACK

Scan Me

Paperback on Amazon

Hold it in your hands

Pair these free worksheets with *Algebra II for Beginners* and you have a complete self-paced course — concept lessons, daily practice, and full exam-style reviews, all in one path. → **EffortlessMath.com/product/algebra-ii-for-beginners**