

ORIGINAL PRACTICE EXAM

2026

AP Precalculus

Questions + worked solutions

40 MULTIPLE CHOICE / 4 FREE RESPONSE / 3 HOURS

A complete practice session, from attempt to review.

Includes calculator and no-calculator sections, tables and graphs, an answer sheet, explanations for every multiple-choice item, and six-point practice rubrics for each free-response question.

2026 format. This packet uses the format in effect for the May 2026 exam. The changes beginning with the May 2027 exam are not used here.

Original, unofficial material. These questions were created for practice; they are not the released or secure 2026 AP exam. Difficulty and scoring are not calibrated by College Board.

Name: _____ Date: _____

How to use this exam

Timing, navigation, and a multiple-choice response sheet

Section	Questions	Time	Calculator
I-A	MCQ 1-28	80 min	Not permitted
I-B	MCQ 29-40	40 min	Graphing required
II-A	FRQ 1-2	30 min	Graphing required
II-B	FRQ 3-4	30 min	Not permitted

Choose one answer for each MCQ. Show reasoning, equations, and units on FRQs. Use radians unless a problem says otherwise. On calculator sections, keep full precision until the end; give nonexact FRQ answers to three decimal places unless directed otherwise.

Pages: MCQ no calculator 3-10; MCQ calculator 11-13; FRQs and workspace 14-21; answer key 22; MCQ explanations 23-30; FRQ solutions and rubrics 31-34; sources and review guide 35.

Practice scoring: MCQ = 40 points; FRQ = 24 points. A weighted practice percentage is $62.5(\text{MCQ}/40) + 37.5(\text{FRQ}/24)$. This is not a conversion to an AP score of 1-5.

Record your choices

01 _____	09 _____	17 _____	25 _____	33 _____
02 _____	10 _____	18 _____	26 _____	34 _____
03 _____	11 _____	19 _____	27 _____	35 _____
04 _____	12 _____	20 _____	28 _____	36 _____
05 _____	13 _____	21 _____	29 _____	37 _____
06 _____	14 _____	22 _____	30 _____	38 _____
07 _____	15 _____	23 _____	31 _____	39 _____
08 _____	16 _____	24 _____	32 _____	40 _____

Section I • Multiple choice

PART A | No calculator | Questions 1-28 | 80 minutes

1. The table gives selected values of f at equally spaced inputs. Which statement best supports a quadratic model for these data?

x	0	1	2	3
$f(x)$	5	9	15	23

- A** The first differences are constant. **B** The second differences are constant and nonzero.
C The ratios of consecutive outputs are constant. **D** The outputs increase by the same percent.

2. Let $p(x) = -2(x + 1)^2(x - 3)^3$. Which statement describes its end behavior?

- A** Both ends approach $+\infty$. **B** Both ends approach $-\infty$.
C As $x \rightarrow -\infty$, $p(x) \rightarrow -\infty$; as $x \rightarrow +\infty$, $p(x) \rightarrow +\infty$. **D** As $x \rightarrow -\infty$, $p(x) \rightarrow +\infty$; as $x \rightarrow +\infty$, $p(x) \rightarrow -\infty$.

3. For $r(x) = [(x - 2)(x + 3)] / [(x - 2)(x - 4)]$, which pair correctly gives a hole and a vertical asymptote?

- A** Hole $(2, -5/2)$; asymptote $x = 4$ **B** Hole $(2, 5/2)$; asymptote $x = 4$
C Hole $(4, 7/2)$; asymptote $x = 2$ **D** Hole $(2, 0)$; asymptote $x = 4$

4. The function f is given by $f(x) = (3x^2 - x + 1)/(2x^2 + 5)$. Which line is a horizontal asymptote of its graph?

- A** $y = 0$ **B** $y = 2/3$
C $y = 3/2$ **D** $y = 3$

5. Let $p(x) = (x + 2)(x - 1)^2(x - 4)$. For which x is $p(x) > 0$?

6. The point $(2, -3)$ is on the graph of f . Which point must be on the graph of $g(x) = -2f(3(x - 1)) + 5$?

7. For $f(x) = -x^2 + 6x + 1$, what is the average rate of change of f over $[1, 4]$?

8. A monic polynomial with real coefficients has zeros 2 and $1 + 3i$. Which polynomial of least possible degree satisfies these conditions?

Section I • Multiple choice

PART A | No calculator | Questions 1-28 | 80 minutes

- 12.** An exponential function has the form $f(x) = ab^x$, where $a > 0$ and $b > 0$. If $f(2) = 18$ and $f(5) = 486$, which formula gives f ?

A $6 \cdot 3^x$

B $2 \cdot 9^x$

C $18 \cdot 3^x$

D $2 \cdot 3^x$

- 13.** Let $h(x) = 5 + 3 \cdot 2^{-x}$. Which statement is true?

A h is increasing and has range $(5, \infty)$.

B h is decreasing and has range $(5, \infty)$.

C h is decreasing and has range $(-\infty, 5)$.

D h is increasing and has range $(-\infty, 5)$.

- 14.** What is the real solution of $\log_2(x - 1) + \log_2(x - 3) = 3$?

A 5

B -1

C -1 and 5

D 4

- 15.** For $f(x) = 4 \cdot 3^{x-2} + 1$, which formula gives $f^{-1}(x)$?

A $\log_3((x + 1)/4) - 2$

B $\log_3(4(x - 1)) + 2$

C $\log_3((x - 1)/4) + 2$

D $\log_4((x - 1)/3) + 2$

Section I • Multiple choice

PART A | No calculator | Questions 1-28 | 80 minutes

16. Selected values of f and g are given in the table. What is $f(g(1))$?

x	-1	0	1	2	3
$f(x)$	2	3	-1	0	1
$g(x)$	1	-1	2	3	0

A -1**B** 1**C** 2**D** 0

17. A plot of $\log_{10}(y)$ versus x is a straight line through $(0, 1)$, $(2, 2)$, and $(4, 3)$. Which model represents the original data?

A $y = 10 \cdot 10^{x/2}$

B $y = 1 + x/2$

C $y = 10 + 5x$

D $y = 10 \cdot 2^x$

18. Let $f(x) = 8(1.5)^x$. Which statement correctly compares the average rates of change over $[0, 1]$ and $[1, 2]$?

A Both rates are 4.**B** The rates are 4 and 6, supporting increase at an increasing rate.**C** The rates are 4 and 2, supporting increase at a decreasing rate.**D** Both rates are 1.5.

Section I • Multiple choice

PART A | No calculator | Questions 1-28 | 80 minutes

19. Which statement describes $k(x) = \log_{1/2}(x + 2)$?

- | | |
|---|--|
| A Its domain is $x > 2$, and it is increasing. | B Its domain is $x > -2$, and it is increasing. |
| C Its domain is $x > -2$, and it is decreasing. | D Its domain is all real numbers, and it is decreasing. |
-

20. An arc of length 5π lies on a circle of radius 6. What is the measure in radians of the central angle that subtends the arc?

- | | |
|-------------------|---------------------|
| A 30π | B $6/(5\pi)$ |
| C $5\pi/3$ | D $5\pi/6$ |
-

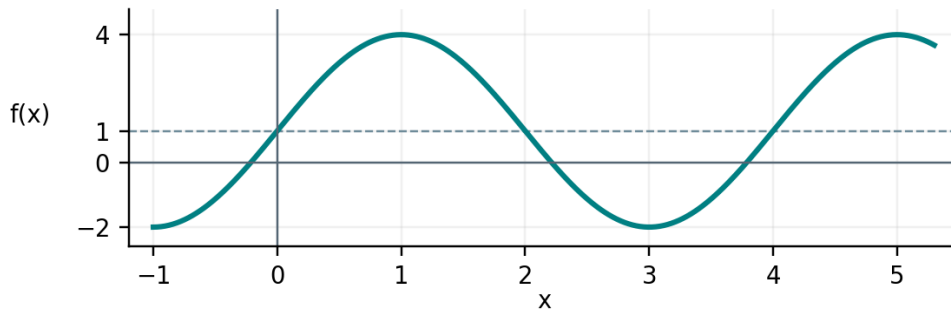
21. If θ is in quadrant III and $\sin \theta = -3/5$, what is $\tan \theta$?

- | | |
|----------------|-----------------|
| A $3/4$ | B $-3/4$ |
| C $4/3$ | D $-4/3$ |

Section I • Multiple choice

PART A | No calculator | Questions 1-28 | 80 minutes

22. Which function represents the sinusoidal graph shown?



A $f(x) = 1 + 3 \sin(\pi x)$

B $f(x) = 1 + 3 \sin(\pi x/2)$

C $f(x) = 3 + \sin(\pi x/2)$

D $f(x) = 1 + 3 \cos(\pi x/2)$

23. What are all solutions of $2 \sin^2 x - \sin x - 1 = 0$ on $0 \leq x < 2\pi$?

A $\pi/6, 5\pi/6, 3\pi/2$

B $\pi/2, 3\pi/2$

C $\pi/2, 7\pi/6, 11\pi/6$

D $\pi/6, 5\pi/6$

24. What is the exact value of $\arcsin(\sin(5\pi/6))$?

A $5\pi/6$

B $-\pi/6$

C $-5\pi/6$

D $\pi/6$

Section I • Multiple choice

PART A | No calculator | Questions 1-28 | 80 minutes

- 25.** For values of x where the original expression is defined, $(1 - \cos(2x))/\sin(2x)$ is equivalent to which expression?

A $\tan x$

B $\cot x$

C $\sin x$

D $2 \tan x$

- 26.** Which set contains all vertical asymptotes of $y = \tan(2x - \pi/3)$? In each choice, k is any integer.

A $x = \pi/6 + k\pi/2$

B $x = 5\pi/12 + k\pi/2$

C $x = 5\pi/6 + k\pi$

D $x = \pi/4 + k\pi/2$

- 27.** Which rectangular coordinates represent the polar point $(-4, 2\pi/3)$?

A $(-2, 2\sqrt{3})$

B $(2, 2\sqrt{3})$

C $(2, -2\sqrt{3})$

D $(-2, -2\sqrt{3})$

- 28.** For the polar curve $r = 2 \cos \theta$, θ increases from $\pi/2$ to π . Which statement is true over the interior of this interval?

A r increases, and distance from the origin increases.

B r increases, and distance from the origin decreases.

C r decreases, and distance from the origin decreases.

D r decreases, and distance from the origin increases.

Section I • Multiple choice

PART B | Graphing calculator required | Questions 29-40 | 40 minutes

29. The equation $x^3 - 4x - 1 = 0$ has exactly one solution in $1 < x < 3$. What is that solution, to the nearest thousandth?

A 1.861
B 2.000
C 2.115
D 4.236

30. Let $p(x) = 0.08x^3 - 1.2x^2 + 4x + 6$ on $0 \leq x \leq 10$. At which x does its graph change from increasing to decreasing?

A 0.000
B 2.113
C 7.887
D 10.000

31. The total cost of producing n items is $4200 + 18n$ dollars. What is the least positive integer n for which the average cost per item is less than \$30?

A 140
B 234
C 350
D 351

32. Use quadratic least-squares regression for the data in the table. What value does the model predict at $x = 5$, to the nearest thousandth?

x	0	1	2	3	4
y	2.1	5.0	10.2	17.1	26.0

A 36.900
B 33.514
C 40.312
D 45.200

Section I • Multiple choice

PART B | Graphing calculator required | Questions 29-40 | 40 minutes

33. Fit $\ln y = \alpha + \beta x$ by least-squares regression to the data. Use $y = e^\alpha e^{\beta x}$ to predict y at $x = 8$. Which value is closest?

x	0	2	4	6
y	120	158	212	278

- A 342.1
B 369.5
C 394.2
D 418.0

34. A culture is modeled by $N(t) = 180e^{0.16t}$, where t is in hours. When does the model predict $N(t) = 500$?

- A 1.022 hours
B 4.500 hours
C 6.385 hours
D 17.361 hours

35. A liquid has temperature $T(t) = 21 + 74(0.86)^t$ degrees Celsius, with t in minutes. At what time does it first reach 30°C ?

- A 8.199 minutes
B 10.854 minutes
C 12.537 minutes
D 13.969 minutes

36. A response is modeled by $R(x) = 2.7 + 1.8 \ln x$ for $x > 0$. What x gives $R(x) = 7$?

- A 10.901
B 2.389
C 5.288
D 48.857

Section I • Multiple choice

PART B | Graphing calculator required | Questions 29-40 | 40 minutes

37. What is the smallest positive solution of $3 \sin(0.7x) = 0.4x$? Use radians.

A 0.000

B 2.601

C 3.742

D 4.488

38. Let $H(t) = 12 + 4.5 \cos((\pi/6)(t - 2))$ for $0 \leq t \leq 12$. For how many total units of time is $H(t) > 15$?

A 1.606

B 3.213

C 4.000

D 8.787

39. For $r(\theta) = 3 + 2 \sin(2\theta)$, what is the average rate of change of r with respect to θ on $0.4 \leq \theta \leq 1.1$? Use radians.

A 0.091

B 0.182

C 0.636

D 0.260

40. A rider's height is $h(t) = 18 - 15 \cos(\pi t/20)$ meters, where $t \geq 0$ is in seconds. At what time does the rider first reach 25 meters?

A 13.091 seconds

B 6.909 seconds

C 20.000 seconds

D 26.909 seconds

Label each part clearly. Include the setup and reasoning that support your answers.

Label each part clearly. Include the setup and reasoning that support your answers.

FRQ 2 • Nonperiodic modeling

PART A | Graphing calculator required | 6 points | Suggested time: 15 minutes

A dissolved substance has concentration $C(t)$ milligrams per liter t hours after observation begins. On $0 \leq t \leq 24$, an exponential model $C(t) = ab^t$ fits the data below exactly. Assume $0 < b < 1$.

t (hours)	0	2	4
C(t) (mg/L)	80	60.8	46.208

- (A)** Find a and b . Show the equations used to determine these constants.
- (B)** (i) Use the model to predict $C(6)$.
(ii) Find the time t when the concentration reaches 12 mg/L.
- (C)** (i) State the percent decrease in concentration over every two-hour interval.
(ii) A linear model L through the first two data points is proposed instead. Find $L(t)$ and explain why it is unsuitable for the entire interval $0 \leq t \leq 24$.

Show your work below and on the following page.

Label each part clearly. Include the setup and reasoning that support your answers.

A wave-testing tank is programmed so that its water depth $d(t)$, in centimeters, varies sinusoidally with time t in minutes. A maximum depth of 11 cm occurs at $t = 1$, the next minimum of 3 cm occurs at $t = 5$, and the next maximum occurs at $t = 9$.

- (B)** (i) Find $d(3)$.
(ii) Find all exact times t in $1 \leq t \leq 9$ when the depth is 9 cm.

- Show your work below and on the following page.

Label each part clearly. Include the setup and reasoning that support your answers.

Show algebraic steps and state any domain restrictions needed in your work. Give exact answers.

(i) Write f as one logarithm and state the domain of the original f .

(i) Find the coordinates of the hole in the graph of r . Justify by factoring.

(C) Solve $2 \cos^2 \theta - 3 \cos \theta + 1 = 0$ for $0 \leq \theta < 2\pi$. Show a factorization and list every solution.

Label each part clearly. Include the setup and reasoning that support your answers.

Label each part clearly. Include the setup and reasoning that support your answers.

Answer key

Stop here until you have attempted the exam.

Multiple choice

Q	Answer	Q	Answer	Q	Answer	Q	Answer
1	B	11	C	21	A	31	D
2	D	12	D	22	B	32	A
3	A	13	B	23	C	33	B
4	C	14	A	24	D	34	C
5	A	15	C	25	A	35	D
6	D	16	D	26	B	36	A
7	B	17	A	27	C	37	C
8	C	18	B	28	D	38	B
9	A	19	C	29	C	39	D
10	B	20	D	30	B	40	A

Score your practice

MCQ correct: _____ / 40

FRQ 1: _____ / 6 FRQ 2: _____ / 6 FRQ 3: _____ / 6 FRQ 4: _____ / 6

FRQ total: _____ / 24

Weighted practice percentage = $62.5(\text{MCQ correct} \div 40) + 37.5(\text{FRQ points} \div 24)$.

Use the six-point rubrics on pages 31-34. They are author-created practice rubrics, not official College Board scoring guidelines. Accept mathematically equivalent correct forms. A bare calculator answer does not earn a point that explicitly requires a setup, explanation, or justification.

Do not infer an AP score of 1-5 from this packet; no official score cutoffs or difficulty calibration are supplied.

Worked solutions • MCQ

Questions 1-5 | Reasoning and calculator setup

1. B | Finite differences

The first differences are 4, 6, and 8. Their differences are 2 and 2. Constant nonzero second differences for equally spaced inputs support a quadratic model.

2. D | Polynomial end behavior

The leading term is $-2x^5$. An odd degree with a negative leading coefficient gives a left end that rises and a right end that falls.

3. A | Holes and asymptotes

Cancel $x - 2$ while retaining the restrictions $x \neq 2, 4$. The reduced expression is $(x + 3)/(x - 4)$. At $x = 2$ its value is $-5/2$, so the hole is $(2, -5/2)$. The uncanceled denominator gives $x = 4$ as a vertical asymptote.

4. C | Rational end behavior

The numerator and denominator have the same degree. Dividing their leading coefficients gives the horizontal asymptote $y = 3/2$.

5. A | Polynomial inequalities

Away from $x = 1$, the squared factor is positive, so the sign is the sign of $(x + 2)(x - 4)$. This product is positive outside its two zeros. Strict positivity excludes $x = -2$ and $x = 4$; $x = 1$ is not in either resulting interval.

Worked solutions • MCQ

Questions 6-10 | Reasoning and calculator setup

6. D | Function transformations

To use $f(2) = -3$, set $3(x - 1) = 2$. This gives $x = 5/3$. Then $g(5/3) = -2(-3) + 5 = 11$.

7. B | Average rate of change

Compute $f(1) = 6$ and $f(4) = 9$. The average rate is $[f(4) - f(1)]/(4 - 1) = (9 - 6)/3 = 1$.

8. C | Complex zeros

Real coefficients require the conjugate zero $1 - 3i$. Thus $p(x) = (x - 2)[(x - 1)^2 + 9] = (x - 2)(x^2 - 2x + 10)$, which expands to choice C.

9. A | Graphical reasoning

On $(-3, -1)$, the graph rises as x increases, but it becomes less steep as it approaches its local maximum. Its secant slopes decrease, so it is concave down on that interval.

10. B | Slant asymptotes

Polynomial division gives $r(x) = x + 2 + 3/(x + 1)$. Therefore $r(x) - (x + 2) = 3/(x + 1)$, which approaches 0.

Worked solutions • MCQ

Questions 11-15 | Reasoning and calculator setup

11. C | Geometric sequences

The common ratio r satisfies $r^3 = 96/12 = 8$, so $r = 2$. Therefore $a_n = 12 \cdot 2^{n-2} = 3 \cdot 2^n$.

12. D | Exponential models

Divide the given outputs: $b^3 = 486/18 = 27$, so $b = 3$. Since $a \cdot 3^2 = 18$, $a = 2$.

13. B | Exponential transformations

Because $2^{-x} = (1/2)^x$, the exponential term decreases and is always positive. Adding 5 gives outputs greater than 5 and a horizontal asymptote $y = 5$.

14. A | Logarithmic equations

The domain requires $x > 3$. Combine logarithms to obtain $(x - 1)(x - 3) = 8$. Then $x^2 - 4x - 5 = 0$, so $x = -1$ or 5 . Only $x = 5$ is in the original domain.

15. C | Inverse functions

From $y = 4 \cdot 3^{x-2} + 1$, obtain $(y - 1)/4 = 3^{x-2}$. Taking log base 3 and adding 2 gives $x = \log_3((y - 1)/4) + 2$. The inverse domain is $x > 1$.

Worked solutions • MCQ

Questions 16-20 | Reasoning and calculator setup

16. D | Function composition

Read the inner function first: $g(1) = 2$. Then read $f(2) = 0$. Thus $f(g(1)) = 0$.

17. A | Semi-log representations

The transformed line has slope $1/2$ and intercept 1: $\log_{10}(y) = 1 + x/2$. Exponentiating base 10 gives $y = 10^{1+x/2} = 10 \cdot 10^{x/2}$.

18. B | Exponential rates of change

The outputs are $f(0) = 8$, $f(1) = 12$, and $f(2) = 18$. For intervals of length 1, the average rates are $12 - 8 = 4$ and $18 - 12 = 6$. Positive, increasing rates are consistent with this increasing, concave-up exponential function.

19. C | Logarithmic behavior

The logarithm argument must be positive: $x + 2 > 0$. A logarithm with base between 0 and 1 is decreasing. A horizontal translation preserves that decreasing behavior.

20. D | Radian measure

Use arc length $s = r\theta$. Therefore $\theta = s/r = 5\pi/6$ radians.

Worked solutions • MCQ

Questions 21-25 | Reasoning and calculator setup

21. A | Trigonometric values

The identity $\sin^2\theta + \cos^2\theta = 1$ gives $|\cos\theta| = 4/5$. In quadrant III, $\cos\theta = -4/5$. Thus $\tan\theta = (-3/5)/(-4/5) = 3/4$.

22. B | Sinusoidal graphs

The maximum is 4 and the minimum is -2, so the amplitude is 3 and the midline is $y = 1$. Consecutive maxima occur at $x = 1$ and $x = 5$, giving period 4 and angular coefficient $2\pi/4 = \pi/2$. The graph crosses the midline upward at $x = 0$, matching the sine model.

23. C | Trigonometric equations

Factor as $(2 \sin x + 1)(\sin x - 1) = 0$. Thus $\sin x = -1/2$ or $\sin x = 1$. On the specified interval these give $x = 7\pi/6$, $11\pi/6$, and $\pi/2$.

24. D | Inverse trigonometric functions

First, $\sin(5\pi/6) = 1/2$. The principal range of $\arcsin$ is $[-\pi/2, \pi/2]$, so $\arcsin(1/2) = \pi/6$.

25. A | Trigonometric identities

Use $1 - \cos(2x) = 2 \sin^2x$ and $\sin(2x) = 2 \sin x \cos x$. Their quotient simplifies to $\sin x/\cos x = \tan x$, on the domain of the original expression.

Worked solutions • MCQ

Questions 26-30 | Reasoning and calculator setup

26. B | Tangent asymptotes

Tangent is undefined when its argument is $\pi/2 + k\pi$. Set $2x - \pi/3 = \pi/2 + k\pi$ and solve: $x = 5\pi/12 + k\pi/2$.

27. C | Polar coordinates

Use $x = r \cos \theta$ and $y = r \sin \theta$. Then $x = (-4)(-1/2) = 2$ and $y = (-4)(\sqrt{3}/2) = -2\sqrt{3}$. A negative r places the point opposite the ray at angle $2\pi/3$.

28. D | Polar rates and distance

Cosine decreases from 0 to -1, so r decreases from 0 to -2. Distance from the origin is $|r|$, which increases from 0 to 2. Signed radius and distance have different behavior here.

29. C | Numerical zeros

Graph $y = x^3 - 4x - 1$ and locate its zero in $(1, 3)$, or use a numerical equation solver. The solution is $x = 2.114907541\dots$, which rounds to 2.115.

30. B | Graphing polynomial extrema

A graphing calculator shows a local maximum at $x = 2.113248654\dots$ and a local minimum at $x = 7.886751346\dots$. The change from increasing to decreasing occurs at the local maximum, $x \approx 2.113$. No differentiation is needed.

Worked solutions • MCQ

Questions 31-35 | Reasoning and calculator setup

31. D | Rational modeling

Average cost is $(4200 + 18n)/n = 4200/n + 18$. Since $n > 0$, the inequality $4200/n + 18 < 30$ gives $n > 350$. Strict inequality makes 351 the least possible integer.

32. A | Quadratic regression

Quadratic regression gives $y \approx 0.978571429x^2 + 2.075714286x + 2.057142857$. Substituting $x = 5$ using unrounded coefficients gives $y = 36.900$.

33. B | Exponential regression

Regressing $\ln y$ on x and exponentiating gives $y \approx 119.8710567(1.151101106)^x$. At $x = 8$, the prediction is 369.5065178..., so 369.5 is closest. Fitting the logarithms is explicitly specified to avoid differences between regression methods.

34. C | Exponential equations

Solve $e^{0.16t} = 500/180$. Taking natural logarithms gives $t = \ln(500/180)/0.16 = 6.385320297...$ hours.

35. D | Shifted exponential decay

Set $21 + 74(0.86)^t = 30$, so $(0.86)^t = 9/74$. Then $t = \ln(9/74)/\ln(0.86) = 13.968970622...$ minutes. The function decreases, so this is its only crossing.

Worked solutions • MCQ

Questions 36-40 | Reasoning and calculator setup

36. A | Inverting a logarithmic model

Rearrange to $\ln x = (7 - 2.7)/1.8$. Exponentiating gives $x = e^{(7-2.7)/1.8} = 10.901374573\dots$

37. C | Numerical trigonometric equations

Find intersections of $y = 3 \sin(0.7x)$ and $y = 0.4x$ in radian mode. Besides $x = 0$, the first positive intersection is $x = 3.741795188\dots$. The zero solution is excluded by the word positive.

38. B | Sinusoidal inequalities

The inequality becomes $\cos((\pi/6)(t - 2)) > 2/3$. The interval $[0, 12]$ is one full period. The angular width is $2 \arccos(2/3)$, so the time length is $(6/\pi) \cdot 2 \arccos(2/3) = 3.212645674\dots$ units.

39. D | Average radial change

The average rate is $[r(1.1) - r(0.4)]/(1.1 - 0.4) = 2[\sin(2.2) - \sin(0.8)]/0.7 = 0.260400894\dots$ radial units per radian.

40. A | Periodic context

Solve $18 - 15 \cos(\pi t/20) = 25$ to obtain $\cos(\pi t/20) = -7/15$. During the first rising half-cycle, $t = (20/\pi) \arccos(-7/15) = 13.090904365\dots$ seconds. The later solution is not the first time.

Worked solution • FRQ 1

Function concepts | Author-created practice rubric | 6 points

A(i). Since $f(3) = 5$, $f^{-1}(5) = 3$.

1 point: correct inverse value.

A(ii). The table gives $f(2) = 2$. Therefore $g(f(2)) = g(2) = 1.8^2 - 2 = \mathbf{1.240}$.

1 point: correct composite value.

B(i). The average rate is $[f(4) - f(1)]/(4 - 1) = (8 - 4)/3 = \mathbf{4/3}$.

1 point: correct average rate.

B(ii). The secant through $(2, 2)$ and $(3, 5)$ has slope 3. Its value at 2.5 is $2 + 3(2.5 - 2) = \mathbf{3.5}$, the requested estimate.

1 point: correct secant-line estimate.

C(i). Since $f(4) = 8$, solve $1.8^x - 2 = 8$. Thus $x = \ln 10 / \ln 1.8 = \mathbf{3.917}$ (approximately).

1 point: correct solution.

C(ii). Solving $y = 1.8^x - 2$ for x gives $\mathbf{g^{-1}(x) = \ln(x + 2)/\ln 1.8}$, with domain $\mathbf{x > -2}$.

1 point: correct inverse formula and domain.

Review focus: A table lookup must follow the order of composition. Inverse inputs are outputs of the original function.

Worked solution • FRQ 2

Nonperiodic modeling | Author-created practice rubric | 6 points

A. $C(0) = a = 80$. Also, $60.8 = 80b^2$, so $b^2 = 0.76$ and $b = \sqrt{0.76} \approx \mathbf{0.871780}$. Thus $C(t) = 80(0.76)^{t/2}$.

2 points: 1 for $a = 80$ with a supporting equation; 1 for $b = \sqrt{0.76}$ with a supporting equation.

B(i). $C(6) = 80(0.76)^3 = 35.11808$, so the prediction is **35.118 mg/L**.

1 point: correct predicted concentration.

B(ii). Solve $80(0.76)^{t/2} = 12$. Then $t = 2 \ln(12/80)/\ln(0.76) = 13.825548680\dots$, or **13.826 hours**.

1 point: correct time.

C(i). Over two hours, the multiplier is $b^2 = 0.76$. The percent decrease is $(1 - 0.76) \times 100\% = \mathbf{24\%}$.

1 point: correct percent decrease.

C(ii). The slope is $(60.8 - 80)/2 = -9.6$, so **$L(t) = 80 - 9.6t$** . For $t > 80/9.6 = 25/3$ hours, $L(t)$ is negative. Negative concentration is impossible, so this model is unsuitable for all of $[0, 24]$.

1 point: correct linear model and a valid contextual explanation.

Review focus: The two-hour multiplier is 0.76; the one-hour multiplier is $\sqrt{0.76}$. Retain the exact form when calculating later predictions.

Worked solution • FRQ 3

Periodic modeling | Author-created practice rubric | 6 points

A(i). Amplitude = $(11 - 3)/2 = 4$ **cm**; midline value = $(11 + 3)/2 = 7$ **cm**; period = $9 - 1 = 8$ **minutes**.

1 point: all three values correct.

A(ii). A cosine model that starts a cycle at the maximum $t = 1$ is **$d(t) = 7 + 4 \cos((\pi/4)(t - 1))$** . Its period is $2\pi/(\pi/4) = 8$. Equivalent sinusoidal formulas are accepted.

1 point: a correct model.

B(i). $d(3) = 7 + 4 \cos(\pi/2) = 7$ **cm**.

1 point: correct depth.

B(ii). Set $\cos((\pi/4)(t - 1)) = 1/2$. Over one cycle, the arguments are $\pi/3$ and $5\pi/3$. Thus $t = 1 + 4/3$ or $1 + 20/3$, giving **$t = 7/3$ and $23/3$ minutes**.

1 point: both exact times and no extra times.

C(i). The depth rises from the minimum at $t = 5$ to the next maximum at $t = 9$. It is increasing on **(5, 9)**. Endpoint notation is not a scoring distinction here.

1 point: correct interval.

C(ii). $[d(5) - d(1)]/(5 - 1) = (3 - 11)/4 = -2$ **cm/min**. From minute 1 to minute 5, the depth decreases by an average of 2 cm per minute.

1 point: correct rate and contextual interpretation.

Review focus: The elapsed time from a maximum to the next minimum is half a period. Exact times should retain fractions and π when appropriate.

Worked solution • FRQ 4

Symbolic manipulations | Author-created practice rubric | 6 points

A(i). The product rule gives $f(x) = \log_2(x^2 - 1)$. Both original arguments must be positive, so the original domain is $x > 1$.

1 point: correct combined logarithm and original domain.

A(ii). $\log_2(x^2 - 1) = 3$ gives $x^2 - 1 = 8$, so $x = \pm 3$. Only $x = 3$ satisfies $x > 1$.

1 point: the valid solution with no extraneous solution.

B(i). Factor $r(x) = [(x - 2)(x - 3)]/[(x - 2)(x + 2)]$. For $x \neq \pm 2$, this equals $(x - 3)/(x + 2)$. The canceled factor gives a hole at $x = 2$; its y-value is $(2 - 3)/(2 + 2) = -1/4$. The hole is **(2, -1/4)**.

1 point: correct hole supported by factoring or cancellation.

B(ii). The remaining denominator vanishes at $x = -2$, while its numerator does not. The vertical asymptote is **$x = -2$** .

1 point: correct vertical asymptote.

C. Factor as **$(2 \cos \theta - 1)(\cos \theta - 1) = 0$** . Thus $\cos \theta = 1/2$ or 1. On $0 \leq \theta < 2\pi$, the complete solution set is **$\{0, \pi/3, 5\pi/3\}$** . The endpoint 2π is excluded.

2 points: 1 for the correct factorization or equivalent reduction; 1 for all three solutions with no extras.

Review focus: Combining logarithms can produce an expression with a larger apparent domain. Keep the restrictions from the original expression.

Review guide and sources

Use missed questions to choose the next topic to study.

Unit	MCQs	Share
1 • Polynomial and rational functions	1-10, 29-32	35%
2 • Exponential and logarithmic functions	11-19, 33-36	32.5%
3 • Trigonometric and polar functions	20-28, 37-40	32.5%

Turn mistakes into a study plan

For each missed item, identify whether the error came from a concept, algebra, graph/table reading, or calculator setup. Redo it without the solution, then explain why the correct answer works. For FRQs, check domain restrictions, exact versus approximate values, and contextual units.

Format and alignment sources

College Board • AP Precalculus Exam

The exam page identifies the 2027 effective date of the announced changes and the four FRQ categories.

<https://apcentral.collegeboard.org/courses/ap-precalculus/exam>

College Board • Clarifications and Corrections

Page 5 records the prior 28/12 MCQ counts, the prior 80-minute Part I-A, and the prior 30-minute times for both FRQ parts. Together with the exam page, this establishes the pre-2027 format used here.

<https://apcentral.collegeboard.org/media/pdf/ap-precalculus-ced-clarification-and-guidance.pdf>

College Board • AP Precalculus Course

Identifies Units 1-3 as exam content and gives the MCQ unit-weight ranges. Unit 4 is excluded from this packet.

<https://apcentral.collegeboard.org/courses/ap-precalculus>

Sources checked October 15, 2026. All question wording, data, graphs, solutions, and practice rubrics in this packet are original. No official exam questions are reproduced.