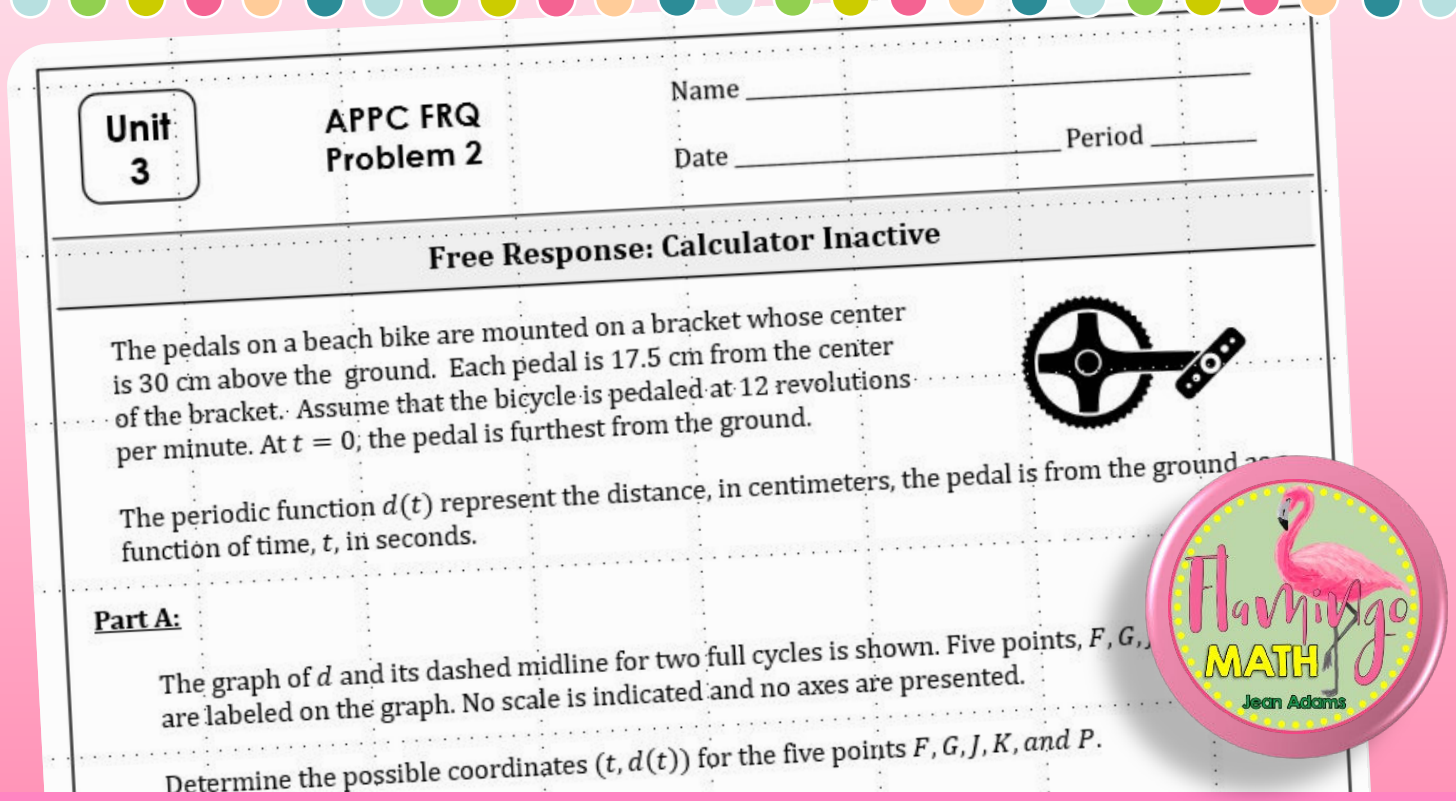
AP® Precalculus

Trigonometric and Polar Functions


Unit 3

APPC FRQ Problem 2

Name _____

Date _____ Period _____

Free Response: Calculator Inactive

The pedals on a beach bike are mounted on a bracket whose center is 30 cm above the ground. Each pedal is 17.5 cm from the center of the bracket. Assume that the bicycle is pedaled at 12 revolutions per minute. At $t = 0$, the pedal is furthest from the ground.

The periodic function $d(t)$ represent the distance, in centimeters, the pedal is from the ground a function of time, t, in seconds.

Part A:

The graph of d and its dashed midline for two full cycles is shown. Five points, $F, G,$ are labeled on the graph. No scale is indicated and no axes are presented.

Determine the possible coordinates $(t, d(t))$ for the five points $F, G, J, K, and\ P$.

Flamingo MATH Jean Adams

Unit 3 Mock AP Exam FRQ's

Trigonometric and Polar Functions
Mock AP Exam FRQ's

KEY CONCEPTS/TOPICS:

- This task model will present a real-life context modeled by either a sine or cosine function. Both parts will require students to construct the sinusoidal model by using the context to determine the amplitude, frequency, period, vertical shift, phase shift, midline, etc.
- There are also questions that ***will not be a word problem.*** It will present several functions: exponential, logarithmic, trigonometric, and/or inverse trigonometric. Exponentials can include natural base, *e*.

About The Product

AP Exam Mock FRQ's Set

This set of five free response questions is designed for AP Precalculus students to practice **Function Concepts for concepts in Unit 3 for the AP Exam**

Using the problem set:

You can use the set as a review for the AP Exam after unit 3 is completed. Each FRQ is designed to be done without a calculator to model the requirements for the AP Exam.

Preparation

1. Copy an FRQ prompt for each student.
2. Have students work the problem set with a calculator or Desmos.
3. Grade on a 6-point scale, included in the key to match the AP Precalculus Exam.

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Product Pages

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Unit 3 — APPC FRQ Problem 1

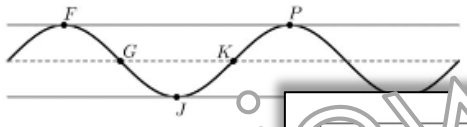
Name _____

Date _____ Period _____

Free Response: Calculator Inactive

The depth of the water at the end of a fishing pier varies with the tide on any given day. Suppose the low tide occurs at 4:30 a.m. and the depth of the water is 8.0 feet, then high tide occurs at 11:00 a.m. with a depth of 12.0 feet. Let $h(t)$ represent the height of the water where t is the time since midnight. The depth of the water increases and decreases periodically with time.

A. The graph of m and its dashed midline for two full cycles is shown below. Five points $F, G, J, K,$ and P are labeled. No scale and axis are represented. Determine the possible coordinate pair $(t, m(t))$ for all five points.



B. The depth of the water at the pier is modeled by the function $m(t) = a\cos[b(t - c)] + d$. Find the value for b

C. Refer to the graph in part A. The t-coordinate of point J is t_2. On the interval (t_1, t_2), which of the following statements must be true?

A. m is positive and increasing
B. m is positive and decreasing
C. m is negative and increasing
D. m is negative and decreasing

D. Describe how the rate of change in m is changing from t_1 to t_2.

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Unit 3 — APPC FRQ Problem 2

Name _____

Date _____ Period _____

Free Response: Calculator Inactive

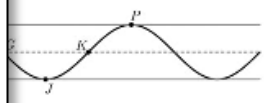
The pedals on a bench bike are mounted on a bracket whose center is 30 cm above the ground. Each pedal is 12 cm from the center of the bracket. Assume that the bicycle is pedaled at 12 revolutions per minute. At $t = 0$, the pedal is furthest from the ground.

The periodic function $d(t)$ represent the distance, in centimeters, the pedal is above the ground as a function of time, t, in seconds.

Part A

The graph of d and its dashed midline for two full cycles is shown. Five points, $F, G, J, K,$ and P, are labeled on the graph. No scale is indicated and no axes are presented.

Determine the possible coordinates $(t, d(t))$ for the five points $F, G, J, K,$ and P.



... in the form $d(t) = a\sin(b[x + c]) + d$. Find the value for b.

... Let the ... and ... be the t-coordinate for the t_2, ... creasing ... decreasing ... ing

... change of d is changing on the interval (t_1, t_2).

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Unit 3 — APPC FRQ Problem 5

Name _____

Date _____ Period _____

Free Response: Calculator Inactive

Part A:

The functions f and g are given by

$$f(x) = \sqrt{2}\sin(2x)$$

$$g(x) = \cos^{-1}\left(\frac{x}{2}\right)$$

i. Solve $f(x) = 1$ for values of x in the interval $[0, \pi]$.

ii. Find the exact value of $g(-\sqrt{3})$ or indicate that it is ... define...

Part B: The functions $h(x)$ and $j(x)$ are given by

$$h(x) = \frac{\cos^2(x)}{1 + \sin(x)} + \sin(x)$$

$$j(x) = \sec(x)\cot(x)$$

i. Rewrite $h(x)$ as a single constant or a single trigonometric function involving no fractions.

ii. Rewrite $j(x)$ as an expression involving $\cos(x)$ and no other trigonometric functions.

Part C: The function $k(x)$ is given by $k(x) = \tan\left(x + \frac{\pi}{2}\right)$. Find all values in the domain $[0, \pi]$ where $k(x) = \sqrt{3}$.

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Unit 3 — APPC FRQ Problem 3

Name _____

Date _____

Free Response: Calculat...

Part A:

The functions f and g are given by

$$f(x) = 2\cos(5x)$$

$$g(x) = \tan^{-1}\left(\frac{x}{3}\right)$$

i. Solve $f(x) = -2$ for values of x in the domain of f.

ii. Solve $g(x) = -1$ for values of x in the domain of g.

Part B:

The functions $h(x)$ and $j(x)$ are given by

$$h(x) = \frac{\sin(2x)}{1 - \cos(x)} - 1$$

$$j(x) = \tan(x)\sec(x)$$

i. Rewrite $h(x)$ as an expression involving $\sin(x)$ and no other trigonometric functions

ii. Rewrite $j(x)$ as an expression involving $\sec(x)$ and no other trigonometric function

Part C

The function $k(x)$ is given by

$$k(x) = 2\sin\left(x - \frac{\pi}{3}\right)$$

Find all the values in the domain of $[0, 2\pi]$ where $k(x) = 1$.

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Name _____

Date _____ Period _____

...e Response: Calculator Inactive

by

$$f(x) = \sin\left(\frac{\pi}{4}x\right) - 1$$

$$g(x) = \tan^{-1}$$

...erval $[0, ...$ ...by $h(x) = (g \circ f)(x) - g(f(x))$. Find the exact value ... it is not defined.

Part B: Let $k(x) = 2\sin\left(\frac{\pi}{4}x\right)\cos\left(\frac{\pi}{4}x\right)$

i. Use a double-angle identity to rewrite $k(x)$ as a single trigonometric function in the form $a\sin(bx)$.

ii. Find the period $k(x)$.

Part C:

i. Find the exact value of $g\left(\tan\left(\frac{2\pi}{3}\right)\right)$.

ii. Given $f(x) = y$, rewrite the expression to solve for x, in terms of $\sin(y)$, for the interval $0 \le x \le 4$.

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