AP Precalculus FRQ #1 Key

2024

(A.i) $h(x) = g(f(x))$

$f(3) = 1$

$h(3) = 2.916(0.7)^{(f(3))}$

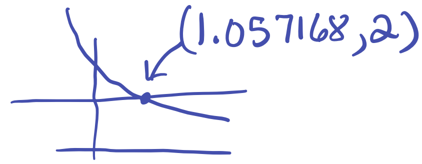
$h(3) = 2.916(0.7)^{1}$

$h(3) = 2.0412$

(ii) $f(x) = 1$ at $x = -3, 0, 3$

(B.i) $g(x) = 2$

when $x \approx 1.05716$



(ii) $\lim\limits_{x \to \infty} g(x) = 0$

(C.i) The function f does not have an inverse that is a function

(ii) On the domain $-3.5 \le x \le 3.5$, f maps a set of input values so that each output is mapped to only one output value. However, the inverse relation of f is not a function because each output value of f is not mapped from a unique input value.

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

$f(x)$ is a function

x	1	1	1
$f^{-1}(x)$	-3	0	3

relation only on inverse.

APPC FRQ#2 Key

(A)(i) $G(t) = a + b\ln(t+1)$

$G(0) = 40{,}000$
$G(91) = 76{,}000$

$$\begin{cases} G(0):\ 40 = a + b\ln(0+1) \\ G(91):\ 76 = a + b\ln(91+1) \end{cases}$$

(ii) $40 = a + b\cancel{\ln(1)}^{0}$

$40 = a$

$76 = 40 + b\ln(92)$

$36 = b\ln(92)$

$b = \frac{36}{\ln 92}$

$b = 7.96145$

$a = 40$

$\underline{\underline{b = 7.961}}$

$395.6\ \frac{\text{units}}{\text{day}}$

B(i) AROC $\frac{G(91) - G(0)}{91 - 0} = \frac{36}{91}$

$\approx 0.39560\ \frac{\text{thousands}}{\text{day}}$

or $395.6\ \frac{\text{units}}{\text{day}}$

(ii) $y - 40 = \frac{36}{91}(x - 0)$

$y = \frac{36}{91}x + 40$

$y = \frac{36}{91}(50) + 40$

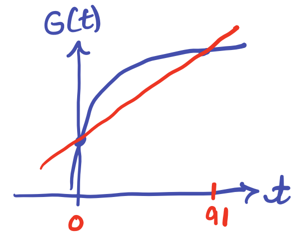
$y = 59.7802$ units

$A(t) = \frac{36}{91}t + 40$

FRQ #2 (cont)

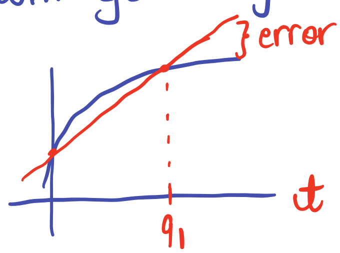
(iii) $G(50) = 40 + 7.961 \ln(51)$ $A_{50} = 59.780$

$G(50) = 71.301$



$A_{50} < G(50)$ since $G(t)$ is increasing at a decreasing rate, $G(t)$ is concave down. On the interval $0 < t < 91$, the average rate of change of the secant line lies below the curve of $G(t)$

(C) After $t = 91$ days the logarithmic function model rate continues to increase at a decreasing rate over time. However, the linear model will continue to increase at a constant rate of change. Therefore, the error will get larger at time increases



error = predicted − actual

APPC FRQ #3 Key

t	$H(t)$ inches
$\frac{1}{2}$	0"
1	9"
$\frac{3}{2}$	18"
2	9"
$\frac{5}{2}$	0"

Period = 2 sec.

A) Points:

F $(1.5, 18)$
G $(2, 9)$
J $(2.5, 0)$
K $(3, 9)$
P $(3.5, 18)$

B) $h(t) = a\sin[b(t+c)] + d$

* $h(t) = 9\sin[\pi(t-1)] + 9$

$a = 9$
$b = \pi$
$c = -1$
$d = 9$

(not unique)

$h(t) = -9\sin[\pi(t-2)] + 9$

where point G is "start"

$\frac{2\pi}{b} = 2$
$b = \pi$

C)(i) On (K, P) the height is positive and increasing. Choice (A).

(ii) On interval (K, P) the rate of change is positive and decreasing because graph is concave down.

APPC FRQ #4 Key

A(i) $10 = e^{x+3}$

$\ln(10) = x+3$

$x = \ln(10) - 3$

(ii) $\arcsin\left(\frac{x}{2}\right) = \frac{\pi}{4}$

$\sin\left(\frac{\pi}{4}\right) = \frac{x}{2}$

$\frac{\sqrt{2}}{2} = \frac{x}{2}$

$x = \sqrt{2}$

B(i) $j(x) = \log_{10}(8x^5) + \log_{10}(2x^2) - 9\log_{10} x$

$j(x) = \log_{10}(16x^7) - \log_{10} x^9$

$j(x) = \log_{10} \frac{16x^7}{x^9}$

$j(x) = \log_{10}\left(\frac{16}{x^2}\right)$

(ii) $K(x) = \left[\frac{1 - \sin^2 x}{\sin x}\right] \sec x$

$k(x) = \left[\frac{\cos^{\cancel{2}} x}{\sin x}\right] \cdot \left[\frac{1}{\cancel{\cos x}}\right]$

$k(x) = \cot x$

$k(x) = \frac{1}{\tan x}$

FRQ #4 Key (cont)

(C)

$$m(x) = \cos^{-1}(\tan(2x))$$

$$0 = \cos^{-1}[\tan(2x)]$$

$$\cos(0) = \cos[\cos^{-1}(\tan(2x)]$$

$$1 = \tan(2x)$$

$$\tan^{-1}1 = \tan^{-1}(\tan(2x))$$

$$\frac{\pi}{4} + \pi n = 2x$$

$$\underline{\underline{x = \frac{\pi}{8} + \frac{\pi}{2}n}}$$ (where n is an integer)