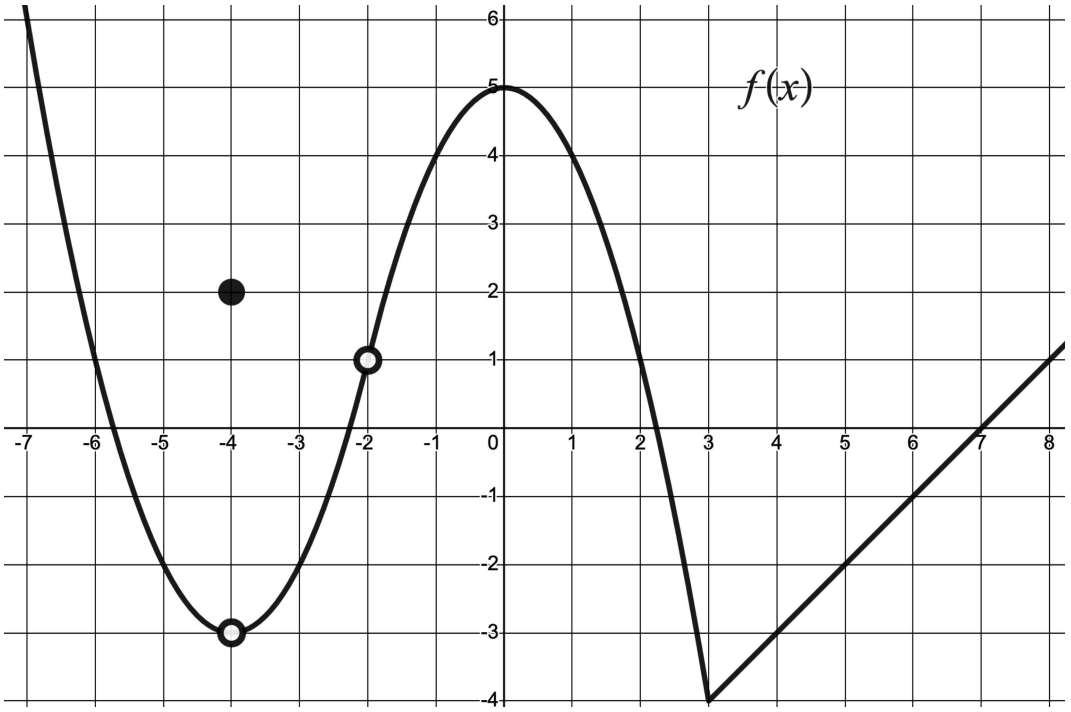
(1) (18 points) Use the graph of the function $f(x)$ and the table of the invertible function $k(x)$ to answer each question below. Write "UND" if a value is undefined.




| $x$ | $k(x)$ |
|---|---|
| -4 | -2 |
| -1 | 1 |
| 1 | 3 |
| 3 | 4 |

(a) $f(-4) =$

(b) $f(-2) =$

(c) $k^{-1}(-2) =$

(d) $(f+k)(1) =$

(e) $f(f(4)) =$

(f) $k(f(3)) =$

(g) $k(k^{-1}(1)) =$

(h) Rank the following from smallest to largest. Enter only the numerals i, ii, iii, and iv in the blanks provided.

i. $AROC_{[-6,2]}$ for $f(x)$

ii. $AROC_{[-2.5,3]}$ for $f(x)$

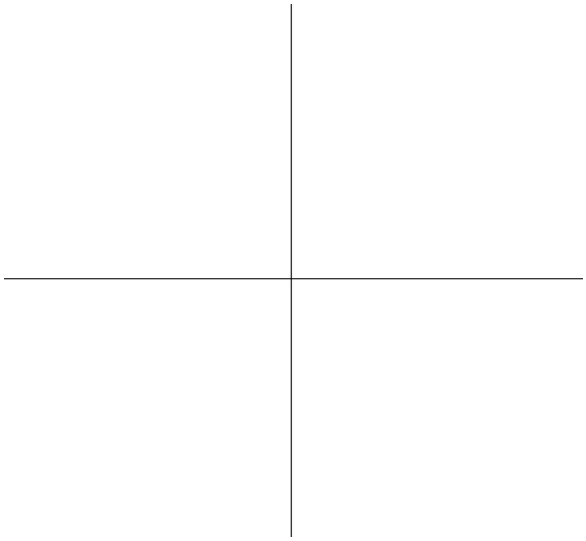
iii. $\dfrac{f(7)-f(-2.5)}{7-(-2.5)}$

iv. $\dfrac{f(0)-f(-4.5)}{0-(-4.5)}$

$\underset{\text{(most negative)}}{\_\_\_\_\_} < \_\_\_\_\_ < \_\_\_\_\_ < \underset{\text{(most positive)}}{\_\_\_\_\_}$

(2) (18 points) Consider the updating function $p_{t+1} = 0.5p_t + 4$, which measures population after $t$ years.

(a) Sketch the graph of the updating function, correctly labeling all axes.



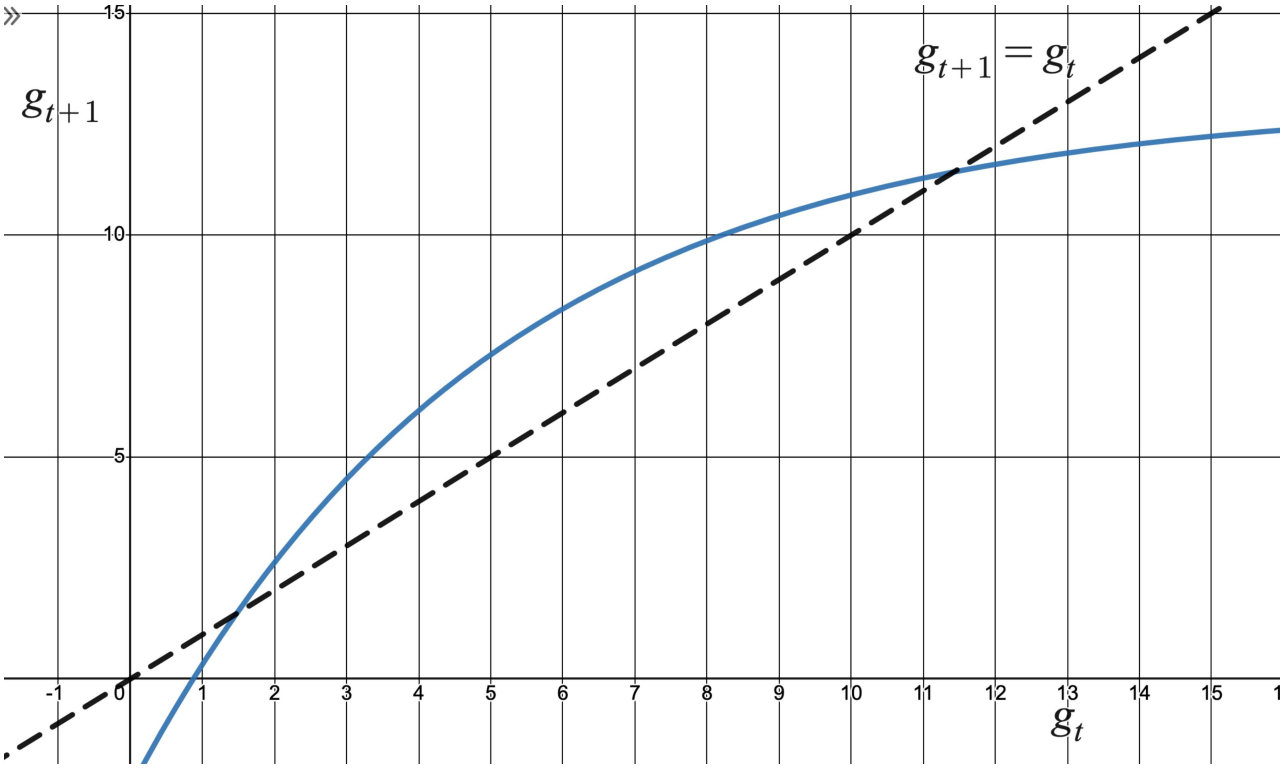
(b) If $p_0 = 20$, complete the following table to determine the value of $p_3$.

| $t$ | $p_t$ | $p_{t+1}$ |
|---|---|---|
| 0 | | |
| 1 | | |
| 2 | | |

$p_3 =$ _____

(c) Find the equilibrium point of this system algebraically. You must show the equation you are using to find the equilibrium point, as well as solve the equation.

(3) (18 points) Below is the graph of an updating function for a DTDS.




(a) If $g_0 = 4$, the solution function is

Increasing Decreasing

*You must illustrate your reasoning on the graph using cobwebbing to receive full credit.*

(b) If $g_0 = 14$, the solution function is

Increasing Decreasing

*You must illustrate your reasoning on the graph using cobwebbing to receive full credit.*

(c) Circle all equilibrium points on the graph, and clearly identify them as stable or unstable.

(4) (15 points) The mass of an object is changing according to the model

$$M(t) = 10e^{0.25t},$$

where $t$ is measured in days.

(a) Is the mass increasing or decreasing? Clearly explain how you know just by looking at the equation for $M(t)$.

Increasing Decreasing

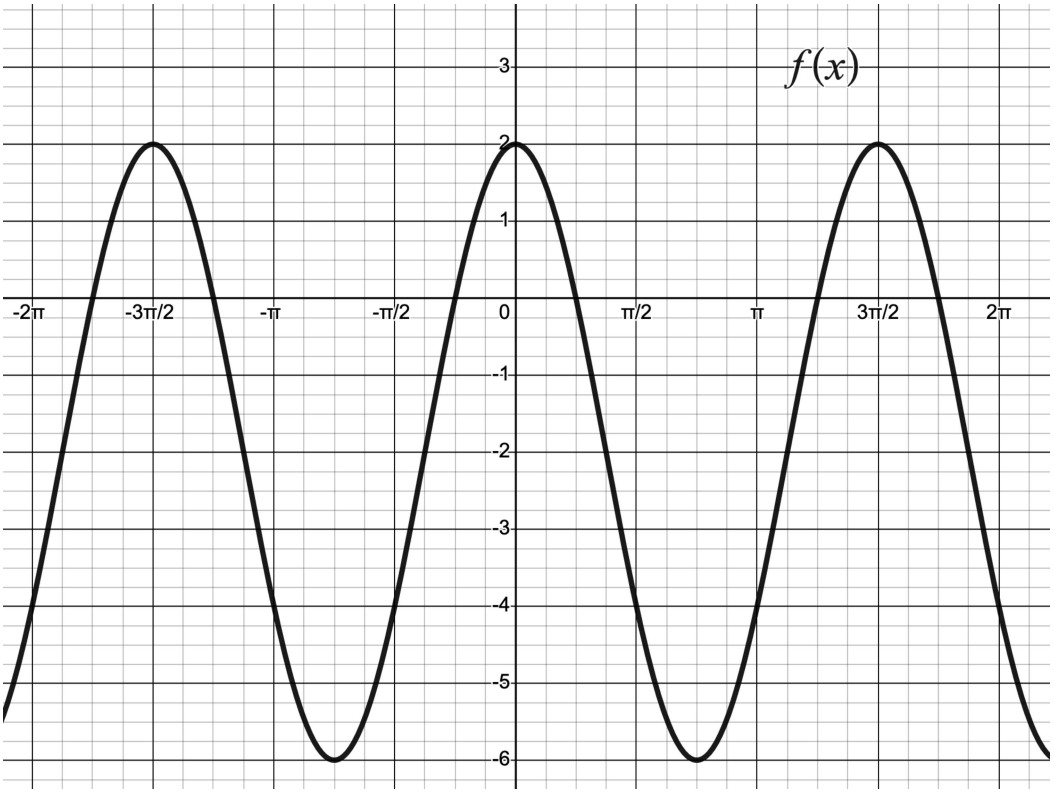
(b) Find the doubling-time or half-life for the object (whichever is appropriate based on your previous answer). You must show the equation you are using to find the doubling-time/half-life, as well as solve the equation.

(c) Determine the value of $\dfrac{AROC_{[2,3]}}{AROC_{[1,2]}}$.

*Note that it is possible to answer this question without making any computation.*

(5) (15 points)

(a)




(i) Which function would you use to model $f(x)$ *without needing to use a phase shift*?

$\sin(x)$ $\cos(x)$

(ii) What is the amplitude, average, and period of $f(x)$?

Amplitude:_____, Average:_____, Period:_____

(b) Let $k(\theta) = 2\sin(\frac{\pi}{3}\theta) + 8$. What is the amplitude, average, and period of $k(\theta)$?

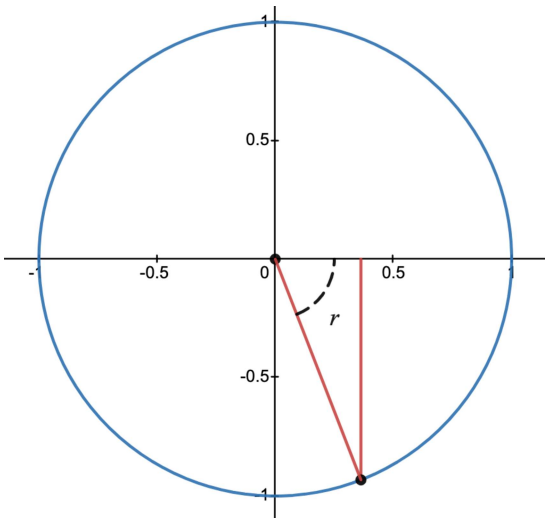
Amplitude:_____, Average:_____, Period:_____

(6) (16 points)

(a) Circle all expressions which could represent a weighted average of $x$ and $y$.

- $0.1x + 0.8y$
- $px + (1-p)y$, where $0 \leq p \leq 1$
- $0.4x + 0.6y$
- $30x + 70y$

(b) Use the picture to circle the correct sign of $\sin(r)$, $\cos(r)$, and $\tan(r)$.




(i) $\sin(r)$ is

$+$ $-$ $0$

(ii) $\cos(r)$ is

$+$ $-$ $0$

(iii) $\tan(r)$ is

$+$ $-$ $0$

(c) Let $\rho = 20$ grams/meter and $d = 3$ meters.

(i) The units of $\rho \cdot d$ are _____

(ii) The units of $\dfrac{\rho}{d}$ are _____

(d) Write the solution function using correct notation associated with each updating function and initial value below.

(i) $d_{t+1} = 0.7d_t$, $d_0 = 3$

(ii) $\ell_{t+1} = \ell_t + 4$, $\ell_0 = 0$