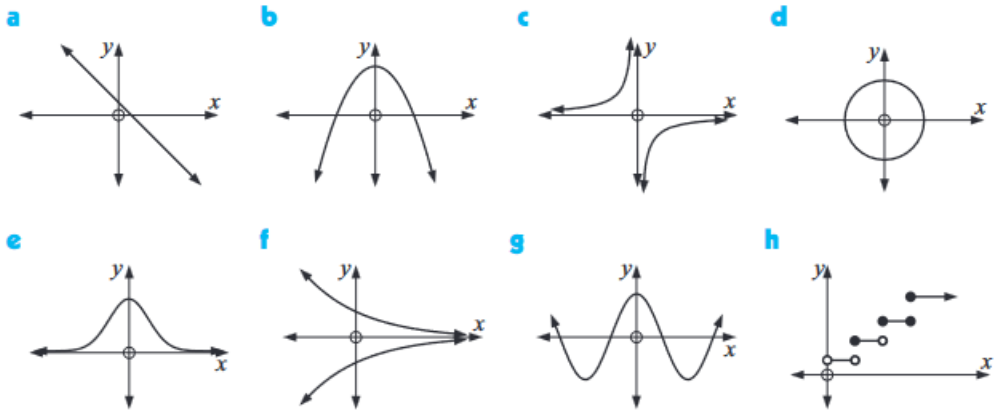
ALGEBRA 2 HONORS
UNIT 1 REVIEW

EXAM DATE: SEPTEMBER 12, 2023

Question 1. For each of the following, determine whether or not the graph is a function.



Question 2. Consider the sequence

a_1 •

a_2 • • •

a_3 • • • • •

a_4 • • • • • • •

a_5 • • • • • • • • •

(a) What is the pattern observed?
(b) Find a formula that describes a_n, i.e., come up with a closed form.
(c) How many dots will be in a_{2023}?

Question 3. For each of the following functions, compute their output:

(a) $f(x, y, z) = 3x^y - z$, compute $f(2, 3, -5)$

(b) $g(x, y, z) = 4$, compute $g(1, 2, 3)$

(c) $h(x) = x^2 - 2$, compute $h(2)$

(d) $j(x, y) = \sqrt{x^2 - y^2}$, compute $j(5, 4)$

(e) $k(a, b) = a + \dfrac{|b - 1|}{2}$, compute $k(\frac{1}{2}, 2023)$

Question 4. Solve for all x that satisfy the inequalities and plot your answer on a number line:

(a) $|x| \geq 3$

(b) $|x| < 3$

(c) $|x + 4| \geq x + 4$

Question 5. Consider the function $f(x) = x^3 - 3x + 1$. Let a_n be a sequence given by the recursive formula

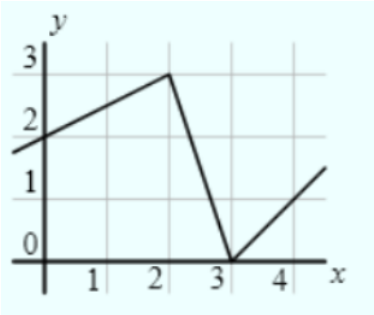
$$a_{n+1} = a_n + f(a_n), \quad \text{for } n \geq 2$$

where $a_1 = 0$. What are the next 3 terms?

Question 6. Find the next 3 terms in each sequence and then write a recursive formula for the sequence, including the initial conditions.

$$(a_n) = (80, 77, 74, 71, 68, \ldots)$$
$$(b_n) = (4, 8, 16, 32, 64, \ldots)$$
$$(c_n) = (\frac{1}{2}, -\frac{1}{4}, \frac{1}{8}, -\frac{1}{16}, \cdots)$$
$$(d_n) = (1, 5, 14, 30, \ldots)$$

Question 7. Consider the graph of $f(x)$ below.



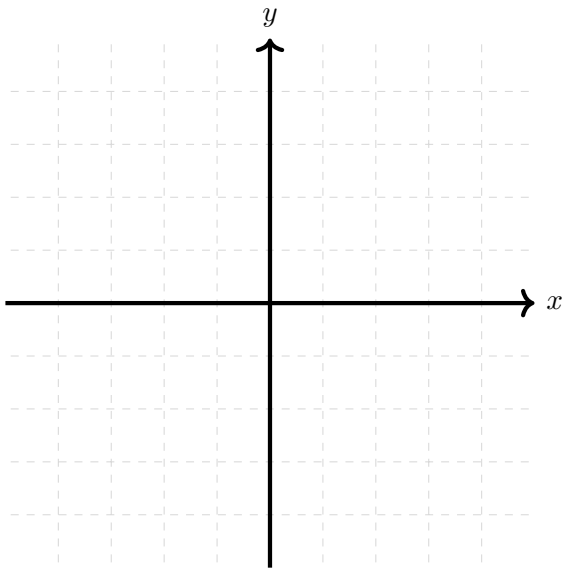
(a) Is the graph of $f(x)$ a function?

(b) What is $f(2)$?

(c) What is x if $f(x) = 2$?

Question 8. Draw a graph of the function

$$f(x) = \begin{cases} 0 & \text{if } x > 3 \\ 3 & \text{if } -2 \leq x < 0 \\ 2 & \text{else} \end{cases}$$



Question 9. Suppose we have a closed form $a_n = \dfrac{(n+1)(n+2)}{n}$. Compute the first 4 terms of the sequence, i.e., compute a_1, a_2, a_3, a_4.

Question 10. Find the 7th term of each of the following sequences:

$$a_n = 2n^2 - 7 \qquad b_n = \frac{3n-1}{n+2} \qquad c_n = 10(n-1) \qquad d_n = 10$$

Question 11. Consider the sequences a_n and b_n.

(a) Suppose we had formulas for the sequences a_n and b_n and we list them below:

$$a_n = \frac{1}{2n+1}, \quad n \geq 1$$

$$b_{n+1} = -b_n + 2, \quad b_1 = 1, \ n \geq 2$$

Compute the first 3 terms of each sequence.

(b) Which sequence in the previous part was written in recursive form? Which one was in closed form?

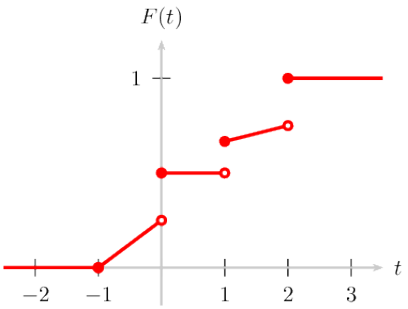
Question 12. Let a_n be a sequence given by the recursive formula

$$a_{n+1} = 2a_n + n \cdot a_{n-1}, \quad \text{for } n \geq 2$$

where $a_1 = 1$ and $a_2 = 1$.

What are the next 3 terms?

Question 13. Consider the graph of the function $F(t)$ below:



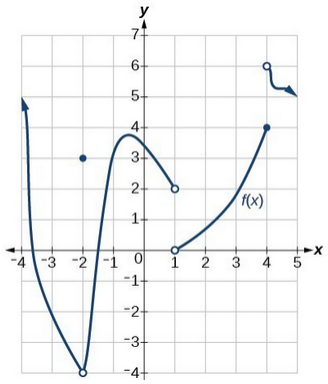
(a) What is the value of $F(1)$?

(b) What is the value of $F(0)$?

(c) What is the value of $F(2)$?

(d) What is the value of $F(-1)$?

Question 14. Compute the values of the following, or state that it does not exist:



(a) $f(1)$
(b) $f(-2)$
(c) $f(0)$
(d) $f(4)$
(e) $\lim_{x\to 4^+} f(x)$
(f) $\lim_{x\to 2^-} f(x)$
(g) $\lim_{x\to 2^+} f(x)$
(h) $\lim_{x\to 2^+} f(x)$
(i) $\lim_{x\to 2^-} f(x)$
(j) $\lim_{x\to 1^+} f(x)$
(k) $\lim_{x\to 1^-} f(x)$

Question 15. Expand each of the following:

(a) $(x+5)(x-3)$

(b) $(x+11)(x-1)$

(c) $(x+\frac{1}{2})(x-\frac{1}{2})$

(d) $(x+\frac{3}{4})(x+\frac{1}{4})$

(e) $(x+2)(x-15)$

(f) $(2x+1)(2x-1)$

(g) $(x+y+z)(z-y-x)$

Question 16. Let ℓ be the line that passes through the points $(2,3)$ and $(6,8)$.

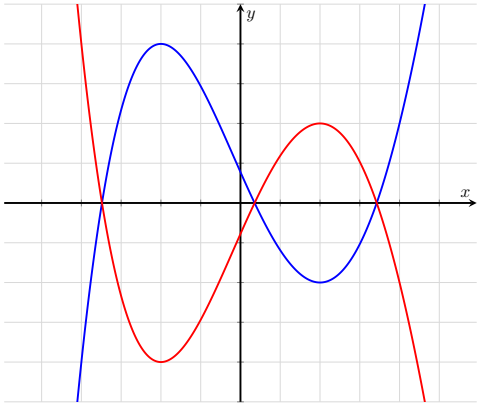
(1) Find the line equation of ℓ:

(2) Is the point $(1, 2)$ on the line ℓ?
(3) Find the line that is parallel to ℓ and passes through $(-15, 0)$.
(4) Find the line that is perpendicular to ℓ and passes through $(-13, 0)$.

Question 17. Let ℓ be the line that passes through the points $(-3, 1)$ and $(1, -3)$.

(1) Find the line equation of ℓ:
(2) Is the point $(2, 0)$ on the line ℓ?
(3) Find the line that is parallel to ℓ and passes through $(-3, 0)$.
(4) Find the line that is perpendicular to ℓ and passes through $(-3, 0)$.

Question 18. Consider the following function which is drawn below:



Shade in the region where $0 < x < 5$ and $f(x) \leq y \leq g(x)$. The function f is the blue curve while the function g is the red curve.