College Algebra Math 1050
October 2018

Sample Midterm Exam

Name: _____

School: _____   Instructor: _____

Scientific (not graphing) calculators are allowed. The point value of each problem is written next to the problem. **You must show your work to receive any credit, except on problems 1–21.** Work neatly.

Fill in the blank or circle the correct answer.

1. (4 points) Write the difference quotient $DQ = \dfrac{f(x+h) - f(x)}{h}$ for the function $f(x) = \sqrt{x-1}$.

Do not simplify.   _____

2. (2 points) The solution of the inequality $|x| \leq 3$ in interval notation is _____.

3. (3 points) The rational expression $\dfrac{x+3}{x^2 - 5x + 6}$ has critical numbers at $x = -3$, $x = 2$, and $x = 3$. Find the solution to the inequality $\dfrac{x+3}{x^2 - 5x + 6} > 0$. Write the solution in interval form.

Answer: _____

4. (4 points) A firefighter holds a hose 3 meters off the ground and directs a stream of water toward a burning building. The height of the water can be approximated by $h(x) = -0.026x^2 + 0.576x + 3$, where $h(x)$ is the height of the water in meters at a point x meters horizontally from the firefighter in the direction of the building. What is the horizontal distance, to the nearest tenth of a meter, from the firefighter at which the maximum height of the water occurs?

Answer: _____

5. (4 points) Consider the inequality $|x + 1| - 3 < 2$. Which correctly describes a first step in solving the inequality?

(a) Nona's first step to solve the inequality is: $x + 1 - 3 < 2$

(b) Lulu's first step to solve the inequality is: $-2 < x + 1 - 3 < 2$

(c) Mari's first step to solve the inequality is: $|x + 1| < 5$

(d) None is a correct step.

Circle all that apply.

6. (3 points) Consider the inequality $\dfrac{2x-1}{x+1} < 3$. Which correctly describes a first step in solving the inequality?

(a) Guga's first step to solve the inequality is: $\dfrac{2x-1}{x+1} - 3 < 0$.

(b) Nino's first step to solve the inequality is: $\dfrac{x-1}{1} < 3$.

(c) Rezo's first step to solve the inequality is: $2x - 1 < 3(x+1)$.

(d) None is a correct step.

Circle all that apply.

7. (3 points) Given a zero (root) $x = -1$ of the polynomial $f(x) = x^3 + 3x^2 + 4x + 2$, find all the remaining zeros (roots) of the polynomial $f(x)$.

Simplify completely. _____

8. (4 points) To simplify the difference quotient $DQ = \dfrac{\frac{1}{x+h} - \frac{1}{x}}{h}$ of the function $g(x) = \frac{1}{x}$, which correctly describes a first step?

(a) David's first step is: $\dfrac{\frac{1}{x} + \frac{1}{h} - \frac{1}{x}}{h}$

(b) Giorgi's first step is: $\dfrac{\frac{1}{x} + h - \frac{1}{x}}{h}$

(c) Alex's first step is: $\dfrac{\left(\frac{1}{x+h} - \frac{1}{x}\right)(x+h)x}{h}\dfrac{1}{(x+h)x}$

(b) None is a correct step.

Circle all that apply.

9. (3 points) A polynomial equation with real coefficients has a zero $x = 4i + 1$.

Another zero is $x =$ _____.

10. (4 points) Given the function

$f(x) = \dfrac{2x-1}{x+1}$ with the domain $D(f) = \{x \mid x \neq -1\}$ and the function

$g(x) = \dfrac{x+1}{x-2}$ with the domain $D(g) = \{x \mid x \neq 2\}$,

find the domain of the function $(f \cdot g)(x)$. Answer: _____

For problems from 11 to 13, consider the function $f(x) = \dfrac{3x - 1}{x^2 + 3x + 2}$.

11. (1 point) The domain of the function $f(x)$ is _____.

12. (1 point) The x-intercept(s) of $f(x)$ is/are _____. Write your answer(s) as ordered pair(s).

13. (1 point) The y-intercept(s) of $f(x)$ is/are _____. Write your answer(s) as ordered pair(s).

For problems from 14 to 15, consider the function $g(x) = \dfrac{x^2 + 3x - 2}{x^2 + 2}$. **Write your answer(s) in equation form.**
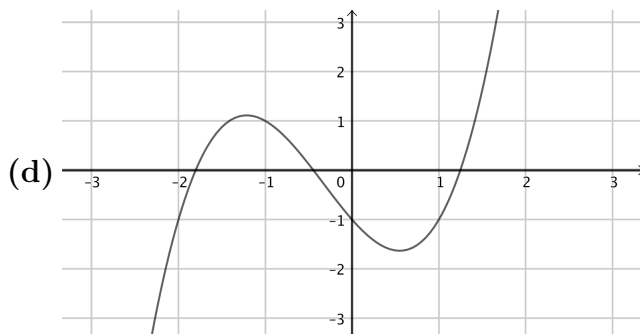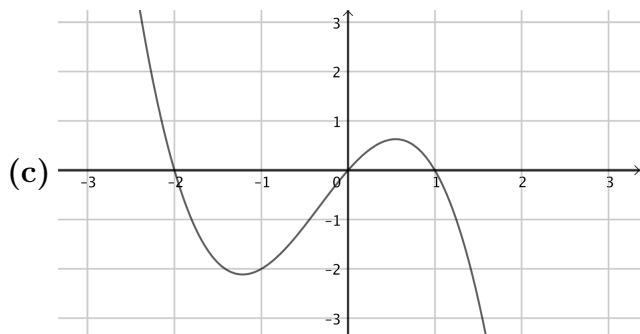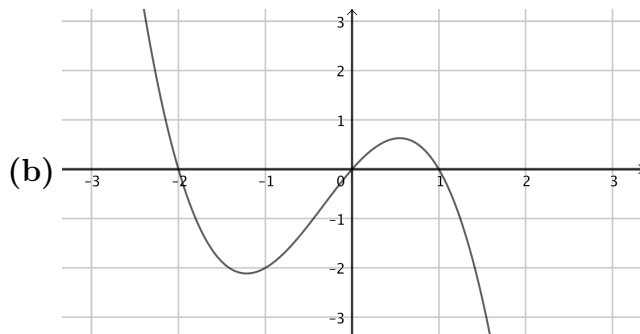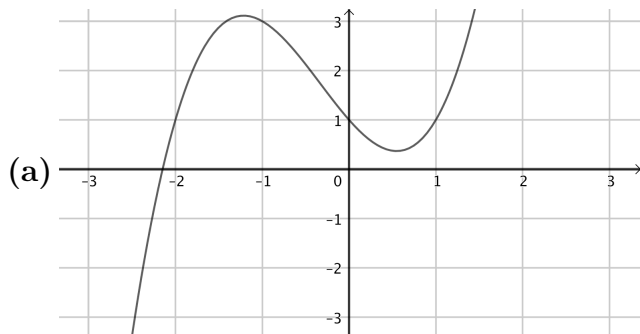
14. (2 points) The vertical asymptote(s), if any, of the function $g(x)$ is (are) _____.

15. (2 points) The non-vertical asymptote(s), if any, of the function $g(x)$ is (are) _____.

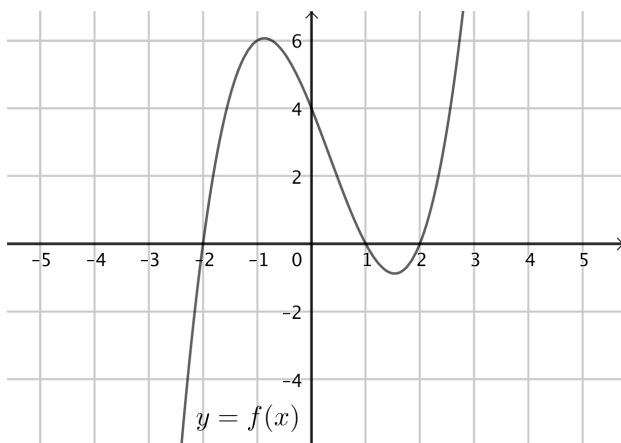**16. (2 points)** Below is a picture of the graph of a function $y = f(x)$.

$y = f(x)$
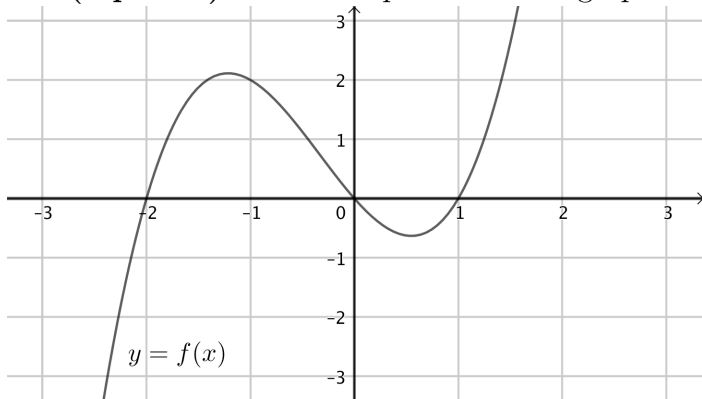
Which of the following is the graph of $g(x) = f(x) - 1$. Mark the correct answer(s).

(a)

(b)

(c)

(d)

17. (4 points) Given the graph of the function $y = f(x)$, let $g(x) = f(x-2) - 1$.

What is $g(0)$? _____

$y = f(x)$

18. (3 points) Given a subset of all possible rational zeros (roots) $-3, -\frac{1}{2}, \frac{3}{2}, 6$ of the polynomial $h(x) = 2x^3 - x^2 - 13x - 6$, find a rational zero of the polynomial $h(x)$.

Answer: _____

19. (3 points) List all solutions to the equation $|x + 4| = 3$.   _____

20. (3 points) Give the list of possible rational zeros (roots) of the polynomial equation

$g(x) = 3x^4 + 7x^2 - 2x + 35 = 0$.   _____

21. (3 points) Given the table shown, evaluate $(f - g)(-1)$.

x	-3	-2	-1	0	1	2	3
$f(x)$	-7	-5	-3	-1	3	5	7
$g(x)$	8	3	0	-1	0	3	8

Answer: _____

22. (8 points) The height of a jumper can be modeled by $h(x) = -0.046x^2 + 0.64x$, where h is the jumper's height in meters and x is the horizontal distance from the point of launch. Explain in 1 to 2 sentences how to find the maximum height of the jumper without relying on having to look at the graph.
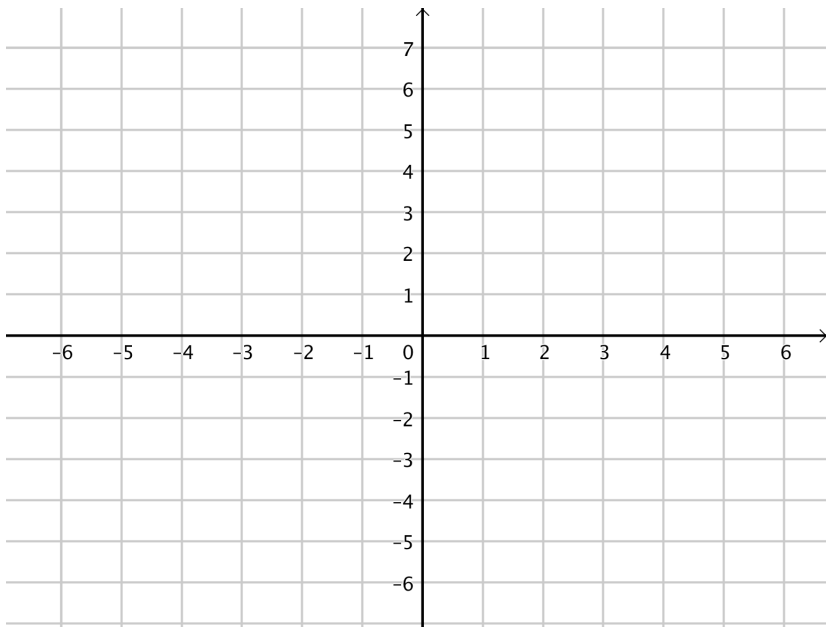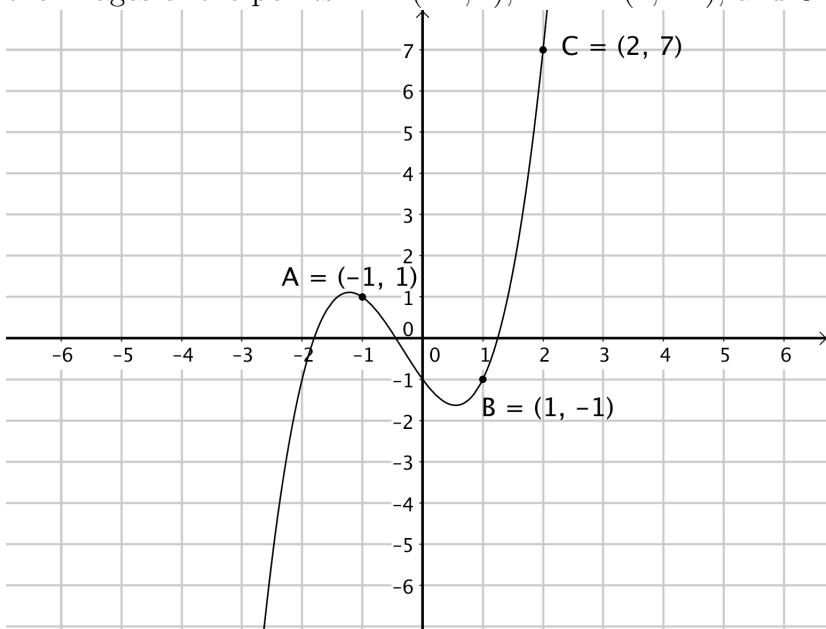***If this were not a sample test, students would be given more room to explain for this question.***

23. (9 points) Graph the rational function $f(x) = \dfrac{x^2 - x - 6}{x - 1}$. Your graph should clearly show and label all x and y intercepts and asymptotes.
If this were not a sample test, students would be given more room to show work for this question.

24. (8 points) Solve the inequality $\dfrac{1}{x - 1} \geq \dfrac{1}{2x + 4}$.   State the solution in interval notation.
If this were not a sample test, students would be given more room to show work for this question.

25. (8 points) The graph of a function $y = f(x)$ is given below. In the subsequent (blank) coordinate plane, sketch the graph of the function $g(x) = -f(x-1)+1$. Be sure your graph shows the images of the points $A = (-1, 1)$, $B = (1, -1)$, and $C = (2, 7)$.

26. (8 points) Solve the inequality $|1 - 2x| > 5$. State the solution in interval notation.

If this were not a sample test, students would be given more room to show work for this question.