MAC 1147 — Fall 2021 — EXAM 2A

Questions 1–23 are worth 4 points each.

1. $g(x)$ is a linear function perpendicular to $f(x) = \frac{4}{3}x + 7$. The two functions intersect when $x = 2$. What is the x-intercept of $g(x)$?

A. $x = \frac{127}{9}$ B. $x = \frac{148}{9}$ C. $x = \frac{134}{9}$ D. $x = \frac{71}{3}$ E. $x = \frac{29}{3}$

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2. Select the function that has exactly one x-intercept. $f(x) = \ldots$

A. $-3x^2 + 12x - 12$ B. $2x^2 - 16x + 25$ C. $4x^2 - 8x + 9$

D. $-2x^2 + 8x - 11$ E. $-3x^2 + 24x - 43$

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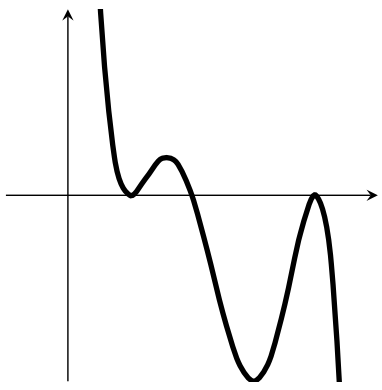
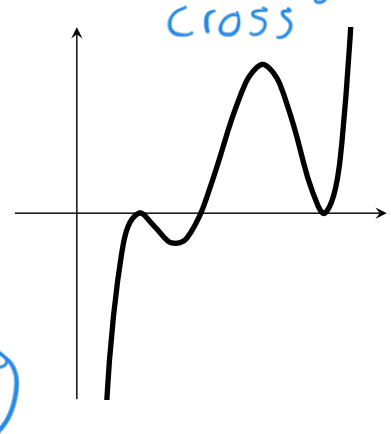
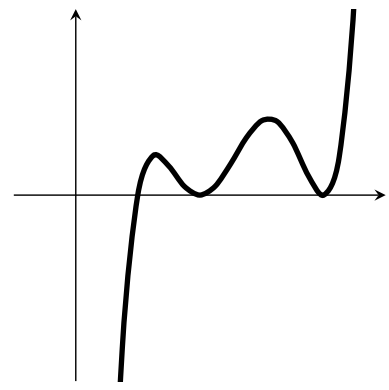
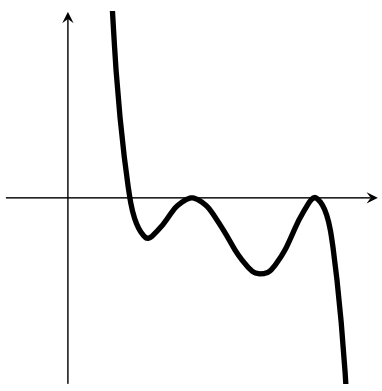
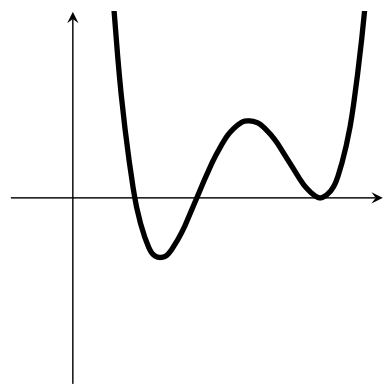
3. Which of these could be the graph of $p(x) = (x-1)^2(x-2)^1(x-4)^2$?

A. 

B. 

C. 

D. 

E. 

4. Select the rational function which has the following properties:

- Has a zero of multiplicity 2 at $x = -1$ and a zero of multiplicity 1 at $x = 1$.
- Has a vertical asymptote at $x = 2$.
- Has a hole at $x = 5$.
- Has a horizontal asymptote of $y = 0$.

$f(x) = \ldots$

A. $\frac{(x-5)(x+1)^2(x-1)}{(x-5)(x-2)}$

B. $\frac{(x-5)(x+1)(x-1)^2}{(x-5)(x-2)}$

C. $\frac{(x-5)(x+1)^2(x-1)}{(x-5)^4(x-2)}$

D. $\frac{(x-5)(x+1)^2(x-1)}{(x-5)(x-2)^5}$

E. $\frac{(x-5)(x-2)}{(x-5)(x+1)^2(x-1)}$

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5. $i^{245} =$

A. 1

B. i

C. -1

D. $-i$

E. The greatest power in the known universe

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6. Select the *false* statement.

A. If $f(x) = \frac{p(x)}{q(x)}$ is a rational function with a vertical asymptote at $x = 7$, then $x - 7$ must be a factor of $q(x)$.

B. The graphs of $f(x) = -x^2$ and $g(x) = x^2 - 8x + 16$ do not intersect.

C. If a rational function $f(x)$ has a hole at $x = 4$ then $f(4)$ is undefined.

D. $g(x) = 2x^3 + 7x^2 - 4x + 5$ is a rational function.

E. A rational function can have two horizontal asymptotes.

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7. Choose the solution to the inequality

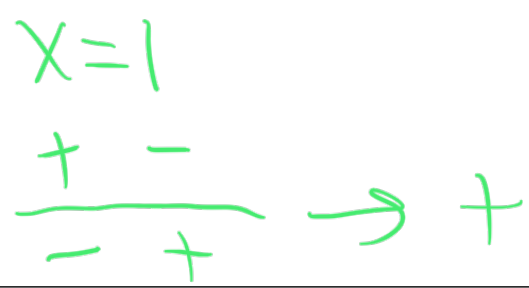
$$\frac{x^2-7x}{x^3-8} \geq 0$$

$$\frac{x(x-7)}{(x-2)(x^2+2x+4)}$$

always positive

A. $(-\infty, 0] \cup [7, \infty)$ B. $(-\infty, 0] \cup (2, 7]$ C. $(2, 7]$

D. $[0, 2) \cup [7, \infty)$ E. $[0, 2)$



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8. Simplify, assuming $x > 2$.

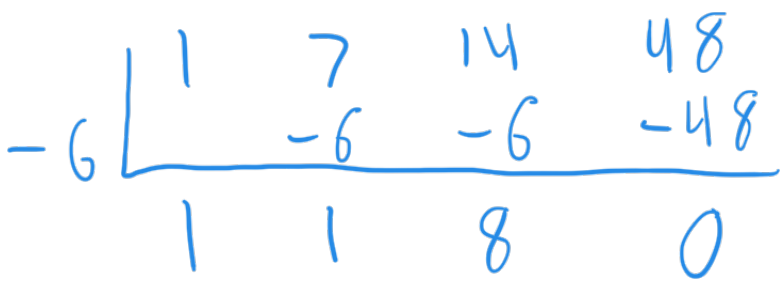
$$\frac{12-3x^2}{x^2+8x+12} \cdot \frac{x^3+7x^2+14x+48}{x-2} =$$

$-3(x-2)(x+2)$ $(x+6)(x^2+x+8)$

$(x+2)(x+6)$

A. $3(x^2 - x + 8)$ B. $-3(x^2 - x + 8)$ C. $-3(x^2 + x + 8)$

D. 1 E. $3(x^2 + x + 8)$



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9. Multiply the complex numbers.

$$(4 + 3i)(7i + 2i^2) =$$

-1

A. $-13 - 34i$ B. $29 - 22i$ C. $22 + 29i$ D. $13 + 34i$ E. $-29 + 22i$

$(4+3i)(-2+7i)$

$= -8 + 28i - 6i + 21i^2 = -29 + 22i$

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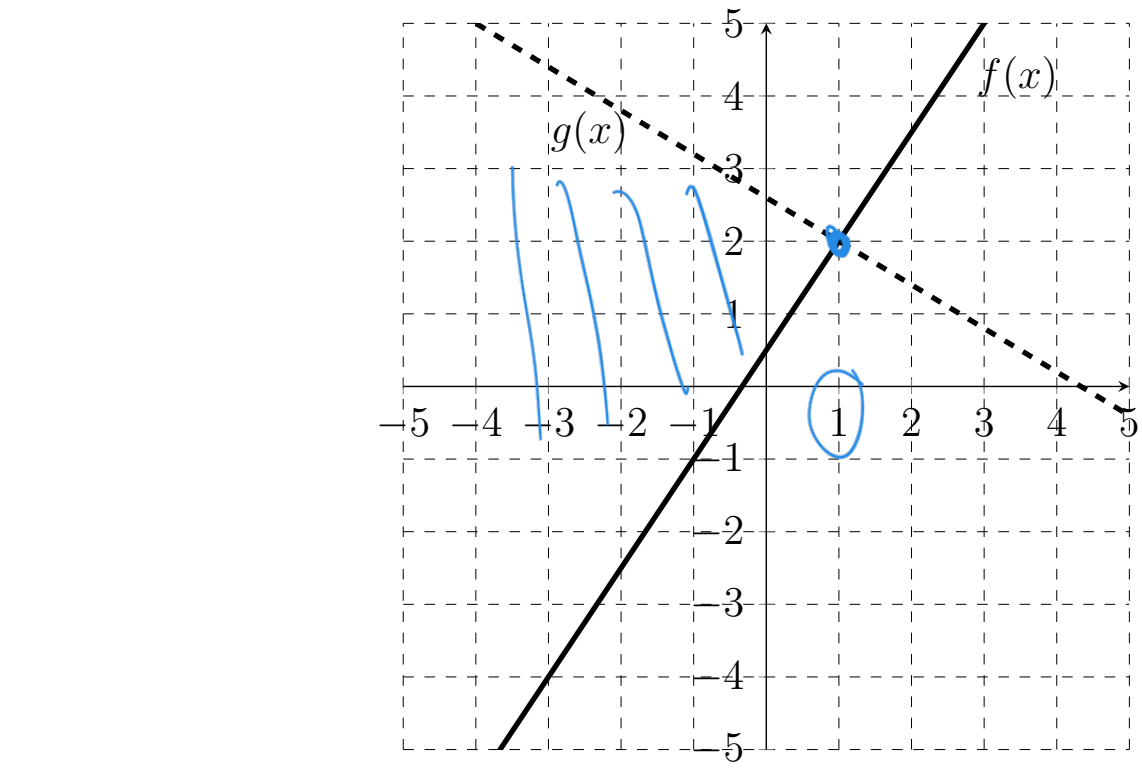
10. Which interval is the solution to the inequality $g(x) \geq f(x)$?



A. $(-\infty, 2]$ B. $[2, \infty)$ C. $(-\infty, 1]$ D. $[1, \infty)$ E. $(-\infty, \infty)$

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11. Choose the solution to the inequality

$$t^3 - 11t^2 + 32t - 28 < 0$$

A. $(-\infty, 2) \cup (2, 7)$ B. $(-\infty, \infty)$ C. $(-\infty, 2) \cup (7, \infty)$

D. $(-\infty, 7)$ E. $(2, 7)$

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12. Suppose $f(x) = x^2 - 8x + 23$ is a quadratic function. $g(x)$ is a linear function with slope 2 that passes through the vertex of $f(x)$. What are the coordinates of the other intersection point of $f(x)$ and $g(x)$?

A. $(6, 11)$ B. $(2, 11)$ C. $(4, 6)$ D. $(6, 7)$ E. $(4, 7)$

13. Choose the solution to the inequality

$$-3|x-5|+11 \leq -13$$

A. $(-\infty,-3]\cup[5,13]$ B. $(-\infty,-3]\cup[13,\infty)$ C. $[-3,13]$

D. $[13,\infty)$ E. There are no solutions

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14. Let

$$P(z)=35z^5-21z^4+42z^3-19z^2+8z+66$$

Choose the value that could *not* be a zero of $P(z)$ according to the Rational Root Test.

A. 1 B. $-\frac{11}{7}$ C. $\frac{2}{3}$ D. $-\frac{1}{5}$ E. -2

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15. Line A is parallel to the x-axis and passes through the point $(4,9)$. Line B is perpendicular to the y-axis and passes through the point $(-6,1)$. At what point do the two lines intersect?

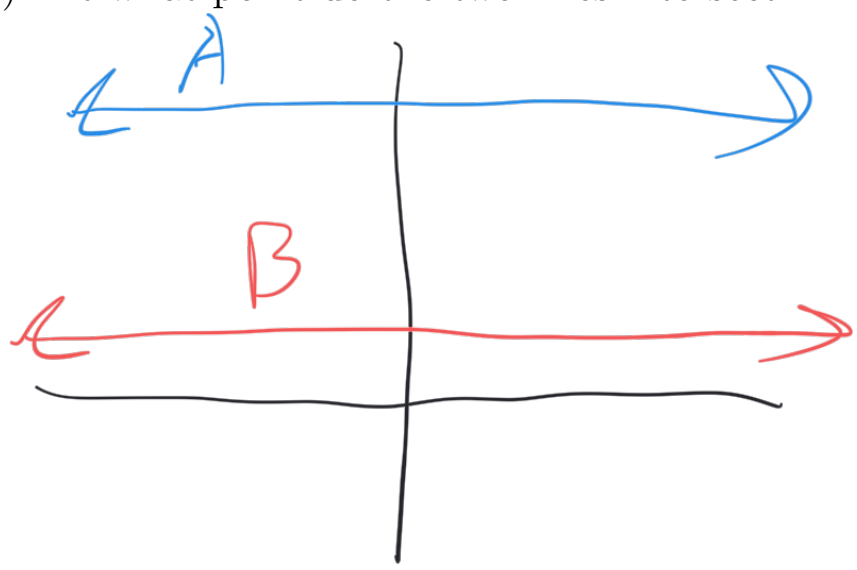
A. $(4,1)$

B. $(-6,9)$

C. $(0,9)$

D. $(-6,0)$

E. Lines A and B do not intersect



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16. Find the sum of all roots (real and complex) of the polynomial.

$$p(x)=x^4-4x^3+28x^2+4x-29$$

A. 3 B. 6 C. $4+10i$ D. $3-10i$ E. 4

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17. Subtract and simplify, assuming $x > 7$.

$$\frac{15x-69}{x^2-9x+20} - \frac{6x-42}{x^2-12x+35}$$

A. $\frac{6}{x-5}$ B. $\frac{7}{(x-4)(x-5)}$ C. $\frac{9}{x-4}$ D. $\frac{4}{(x-5)(x-7)}$ E. 1

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18. Select the *true* statement about a polynomial $f(x)$ with real coefficients.

A. If the leading coefficient of $f(x)$ is negative, then $f(x)$ has no real number roots.

B. If $4+7i$ and $4-7i$ are the only zeros of $f(x)$, then $f(x)$ has an odd degree.

C. If $5+2i$ is a zero of $f(x)$, then x^2+29 must be one of its factors.

D. If $f(x)$ has degree larger than 1 at least one root, then product of all of its roots is a real number.

E. If $x = a$ is a zero of $f(x)$ then $(x+a)$ is a factor of $f(x)$

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19. Which statement describes the behavior of $f(x)$?

$$f(x) = -8x^5 + 9x^4 - 2x^3 + 11x^2 + 5x + 13$$

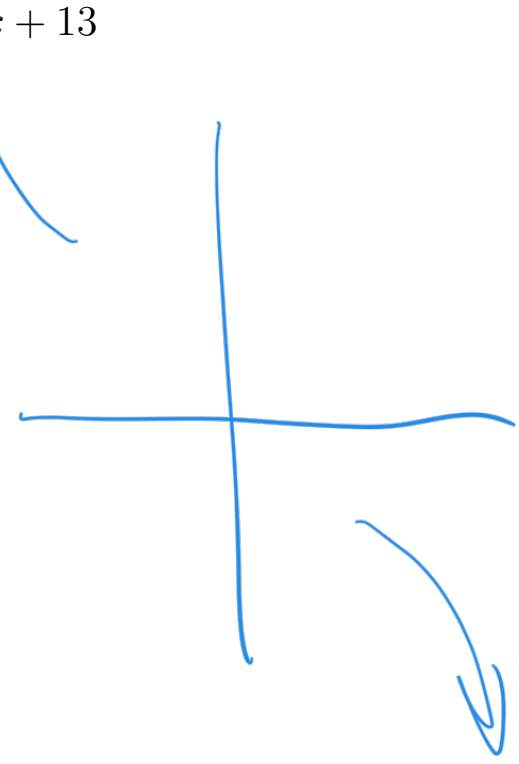
A. As $x \to \infty, f(x) \to \infty$ and as $x \to -\infty, f(x) \to -\infty$

B. As $x \to \infty, f(x) \to -\infty$ and as $x \to -\infty, f(x) \to \infty$

C. As $x \to \infty, f(x) \to -\infty$ and as $x \to -\infty, f(x) \to -\infty$

D. As $x \to \infty, f(x) \to \infty$ and as $x \to -\infty, f(x) \to \infty$

E. $f(x)$ takes long walks on the beach and plays guitar.



20. Identify the horizontal asymptote of the function.

$$f(x) = \frac{8x^6+3x^5+7x^2}{5x^5+11x^4+2x^3}$$

A. $y = 0$

B. $y = \frac{8}{5}$

C. $y = \frac{7}{2}$

D. $y = 1$

E. $f(x)$ has no horizontal asymptote

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21. Which quadratic function has vertex $(3, -7)$ and passes through the point $(5, 1)$?

A. $f(x) = 2x^2 - 12x - 11$

B. $f(x) = 2x^2 - 12x + 11$

C. $f(x) = x^2 - 6x - 2$

D. $f(x) = x^2 - 6x + 2$

E. $f(x) = 2x^2 - 6x + 2$

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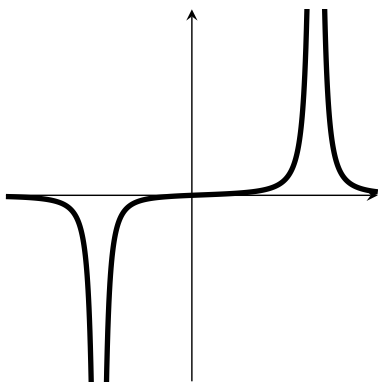
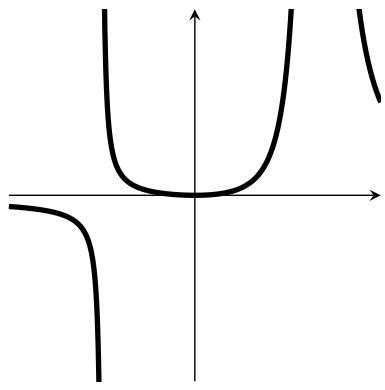
22. Which of these could be the graph of

$$g(x) = \frac{x}{(x+3)(x-4)^2}$$

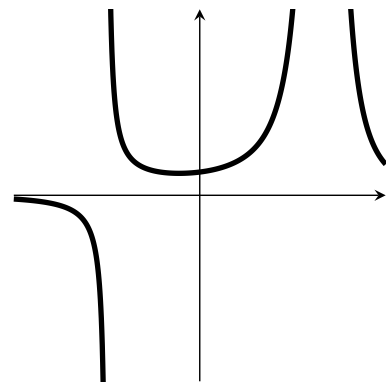
A.



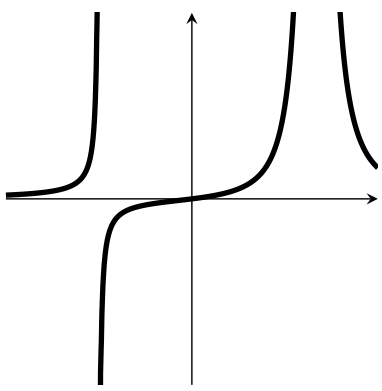
B.



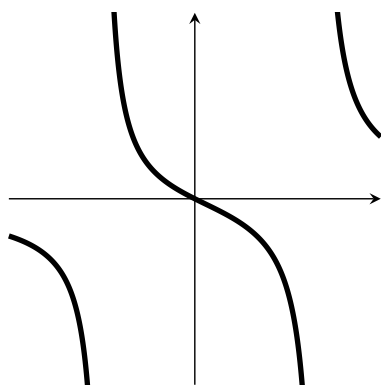
C.



D.



E.



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23. Which value of b in the system below will produce a system with no solutions?

$$4x + 7y = 21$$
$$-12x + by = -68$$

A. -7 B. 0 C. 7 D. -21 E. 21

$(4x + 7y = 21)\ 3$

$-12x - 21y = -68$

$12x + 21y = 63$

$-12x - 21y = -68$

$0 = -5$

not true

and variables gone

MAC 1147 — Fall 2021 — EXAM 2A

T.A. _____ Disc. Per. ____ Name _____

Honor Pledge: "On my honor, I have neither given nor received unauthorized aid for this exam."

UF ID # _____ Signature _____

YOU MUST SHOW ALL WORK TO RECEIVE FULL CREDIT.

Free response questions 24-25 are worth 4 points each.

24. $f(x)$ is a parabola that passes through the points $(2, 13), (6, 13)$ and $(0, 37)$

a. (3 pts) $g(x)$ is formed by shifting the graph of $f(x)$ down vertically by 13 units. Find a formula for $g(x)$ in standard form.
Hint: Write the coordinates of some points on $g(x)$.

$a = 2$

$(2,0)$ $(6,0)$ $(0,24)$

x-ints

$g(x) = a(x-2)(x-6)$

Plug in $(0, 24)$

$24 = a(0-2)(0-6)$

$g(x) = 2(x-2)(x-6)$

$= 2x^2 - 16x + 24$

$= 2(x-4)^2 - 8$

b. (1 pt) Find a formula for $f(x)$ in standard form.

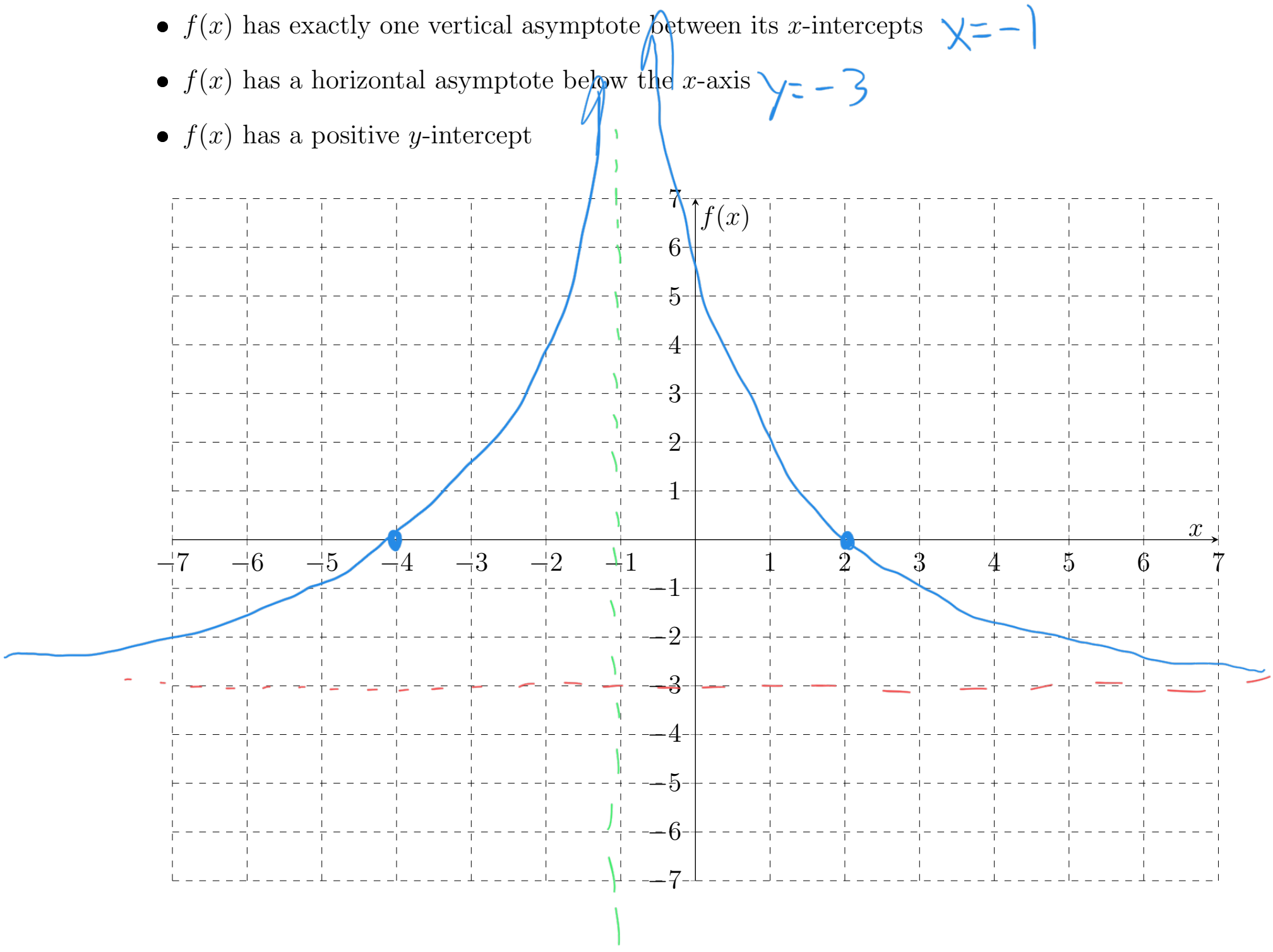
$f(x) = g(x) + 13$

$= 2(x-4)^2 - 8 + 13$

$f(x) = 2(x-4)^2 + 5$

25. Construct a rational function $f(x)$ with the properties listed below. Write the formula for your function in factored form and sketch its graph. Each property is worth 1 point and must be evident in both graph and formula.

- $f(x)$ has exactly one positive x-intercept and exactly one negative x-intercept
- $f(x)$ has exactly one vertical asymptote between its x-intercepts
- $f(x)$ has a horizontal asymptote below the x-axis
- $f(x)$ has a positive y-intercept



$f(x) =$ $-3\dfrac{(x-2)(x+4)}{(x+1)^2}$

Turn in your scantron and your free response to your TA. The worked-out solutions will be posted on Canvas after the test.