

MATH 110 (Holland)
FINAL EXAM
Spring 2004

Name _____
Section _____

Directions: On the answer sheet, fill in the following in the appropriate spaces and darken the corresponding ovals:

1. Last name, first and middle initials.
2. Student ID Number. (LEFT-justify the 6 digits in the ID field leaving the last 3 spaces blank.)

3. Section:

A1=11, A2=12, A3=13, A4=14, A5=15, A6=16, A7=17, A8=18

B2=22, B4=24, B6=26, B8=28

C1=31, C2=32

4. Form A

5. Your signature on the back.

Problems: Check that your exam contains exactly 40 problems. Each problem is worth 5 points. Choose the best answer for each problem. Circle the answer on the exam and darken the corresponding oval on the answer sheet.

1. Simplify $\frac{\sqrt[3]{x^2y^4} \sqrt[3]{125x^4}}{\sqrt[3]{8x^3y^4}}$.

(a) $\frac{512y^{10}}{125x^6}$

(d) $\frac{5x}{2}$

(b) $\frac{25x^2 \sqrt[3]{y^2x}}{8}$

(e) $\frac{125x}{8}$

(c) $\frac{5x \sqrt[3]{x}}{6}$

2. Simplify $\frac{(2\sqrt{5} - 3)(\sqrt{5} + 1)}{\sqrt{5} - 2}$.

(a) $\frac{7\sqrt{5} - 14}{3}$

(d) $\frac{5\sqrt{5} + 9}{3}$

(b) $7\sqrt{5} + 14$

(e) $5\sqrt{5} + 9$

(c) 1

3. Simplify and factor $\frac{9 - \frac{1}{x^2}}{16 + \frac{1}{x^2}}$.

(a) $\frac{9}{16}$

(d) $\frac{(3x + 1)(3x - 1)}{(4x + 1)^2}$

(b) $\frac{(3 - x)(3 + x)}{16 + x^2}$

(e) $\frac{(3x + 1)(3x - 1)}{16x^2 + 1}$

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

4. The equation $15x^{-2} - 2x^{-1} - 1 = 0$ has

- (a) NO real solutions.
- (b) exactly ONE real solution, which is POSITIVE.
- (c) exactly ONE real solution, which is NEGATIVE.
- (d) exactly TWO real solutions, whose product is -15 .
- (e) exactly TWO real solutions, whose product is $\frac{-1}{15}$.

5. Find the factored, reduced form of the expression $\frac{\frac{x+3}{16-x^2}}{\frac{x^2-9}{4-x}}$.

- (a) $\frac{1}{(x-3)(x+4)}$
- (b) $\frac{(x-4)^2(x+4)}{(x+3)^2(x-3)}$
- (c) $\frac{(x+3)^2(x-3)}{(x-4)^2(x+4)}$
- (d) $\frac{x+4}{x-3}$
- (e) $\frac{x-3}{x+4}$

6. Factor the expression $x^{1/2}(x^2+x) - 3x^{3/2} - 3x^{1/2}$ (where $x \geq 0$).

- (a) $x^{1/2}(x+1)(x-3)$
- (b) $x^{3/2}(x+1)(x-3)$
- (c) $x^{3/2}(x+2)(x-6)$
- (d) $x^{1/2}(x+6)(x-4)$
- (e) $(x+6)(x-4)$

7. Which of the following is true of the equation $\frac{3}{20-x} = \frac{7}{(20-x)(x+8)} - \frac{4}{x+8}$?

- (a) It has NO real solutions.
- (b) It has exactly ONE real solution, which is POSITIVE.
- (c) It has exactly ONE real solution, which is NEGATIVE.
- (d) It has exactly TWO real solutions, whose sum is 5.
- (e) It has exactly TWO real solutions, whose sum is -5 .

8. Find the factored, reduced form of $\frac{-3(x+4)^{1/2} + 6x(x+4)^{-1/2}}{x+4}$, where $x > -4$.

- (a) $\frac{3}{(x+4)^{1/2}}$
- (b) $\frac{3(x-4)}{(x+4)^{1/2}}$
- (c) $\frac{3(x-4)}{(x+4)^{3/2}}$
- (d) $\frac{3}{(x+4)^{1/2}}$
- (e) $\frac{-3}{(x+4)^{3/2}}$

9. Find the factored, reduced form of the expression $\frac{x}{x-3} - \frac{x+1}{x^2+5x-24}$.

- (a) $\frac{x^2+7x-1}{(x-3)(x+8)}$
- (b) $\frac{1}{(x-3)^2(x+8)}$
- (c) $\frac{-1}{x+8}$
- (d) $\frac{x^2+7x+1}{(x-3)(x+8)}$
- (e) $\frac{x^2+7x+1}{(x-3)(x-8)}$

10. If x gallons of cherry juice costing \$3.00 per gallon are to be combined with y gallons of apple juice costing \$1.00 per gallon to make a fruit juice mix costing \$2.50 per gallon, then what is $\frac{x}{y}$?

(a) 3

(d) $\frac{8}{5}$

(b) 10

(e) $\frac{5}{8}$ cannot be determined

(c) $\frac{1}{3}$

11. Which of the following is an equation of the line passing through the point $(5, -4)$ and PERPENDICULAR to the line with equation $3x - 5y + 2 = 0$?

(a) $y = 3x - 4$

(b) $y = 3x - 19$

(c) $y = \frac{3}{5}x - 7$

(d) $y = \frac{5}{3}x - 4$

(e) $y = -\frac{5}{3}x + \frac{13}{3}$

12. The graph of the line with equation $5x - 3y - 2 = 0$ has

(a) x -intercept $(-2/3, 0)$ and y -intercept $(0, 2/5)$

(b) x -intercept $(2/5, 0)$ and y -intercept $(0, -2/3)$

(c) x -intercept $(3, 0)$ and y -intercept $(0, -5)$

(d) x -intercept $(-5, 0)$ and y -intercept $(0, 3)$

(e) x -intercept $(3/2, 0)$ and y -intercept $(0, -5/2)$

13. The graph of the equation $x^2 + y^2 - 2x - 6y + 7 = 0$ is
- (a) a circle with center $(3, 1)$ and radius 3.
 - (b) a circle with center $(3, -1)$ and radius $\sqrt{3}$.
 - (c) a circle with center $(1, 3)$ and radius $\sqrt{7}$.
 - (d) a circle with center $(1, 3)$ and radius $\sqrt{3}$.
 - (e) not a circle.
14. Which of the following is true of the equation $\sqrt{12 - 2x} = x - 2$?
- (a) It has NO real solutions.
 - (b) It has exactly ONE real solution, which is POSITIVE.
 - (c) It has exactly ONE real solution, which is NEGATIVE.
 - (d) It has exactly TWO real solutions, whose SUM is 2.
 - (e) It has exactly TWO real solutions, whose SUM is -2 .
15. Find the solution set of the equation $3(2 - x) \leq 5 - 4(x - 3)$.
- (a) the inequality has no solutions
 - (b) $[13, \infty)$
 - (c) $[11, \infty)$
 - (d) $(-\infty, -13]$
 - (e) $(-\infty, 11]$

16. Which of the following is true of the equation $t - 2t^{1/2} - 24 = 0$?

- (a) It has NO solutions.
- (b) It has exactly ONE real solution, which is POSITIVE.
- (c) It has exactly ONE real solution, which is NEGATIVE.
- (d) It has exactly TWO real solutions.
- (e) It has exactly FOUR real solutions.

17. Find the solution set of the inequality $|5 + 6x| \geq 17$.

- (a) $\{x : x \leq 2 \text{ or } x \geq -11/3\}$
- (b) $\{x : x \geq 2 \text{ or } x \leq -11/3\}$
- (c) $[-11/3, 2]$
- (d) $(-\infty, 2]$
- (e) all real numbers

18. What is the domain of the function f defined by $f(x) = \frac{x+2}{\sqrt{5+3x}}$?

- (a) $(-\infty, 0]$
- (b) $(-\infty, 0)$
- (c) $(-2, \infty)$
- (d) $(-5/3, \infty)$
- (e) $(-\infty, -5/3)$

19. What is the domain of the function G defined by $G(x) = \frac{x-3}{x^3+3x^2-10x}$?

- (a) all reals except 3
- (b) all reals except 2, -5, 0
- (c) all reals except 2, -5, 3, 0
- (d) $\{2, -5, 3, 0\}$
- (e) $\{2, -5, 0\}$

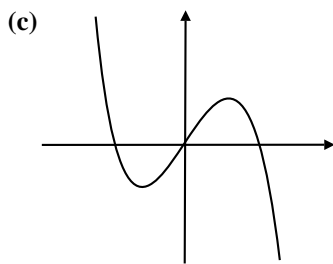
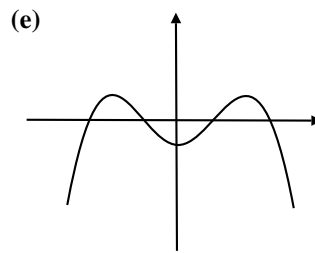
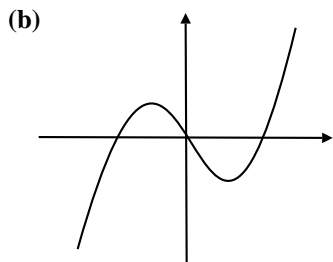
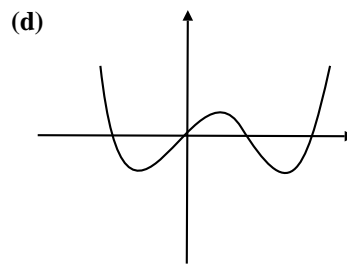
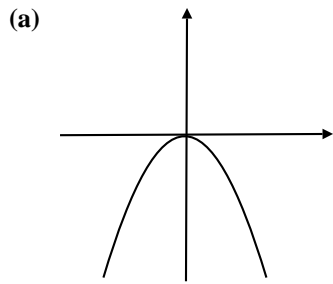
20. If $f(x) = \frac{2x+1}{3x-5}$, and $g(x) = 3x+1$, find $(f \circ g)(x)$.

- (a) $(f \circ g)(x) = \frac{6x-2}{3x-5}$
- (b) $(f \circ g)(x) = \frac{6x+2}{9x-4}$
- (c) $(f \circ g)(x) = \frac{6x+3}{9x-2}$
- (d) $(f \circ g)(x) = \frac{(2x+1)(3x+1)}{(3x-5)}$
- (e) none of the above

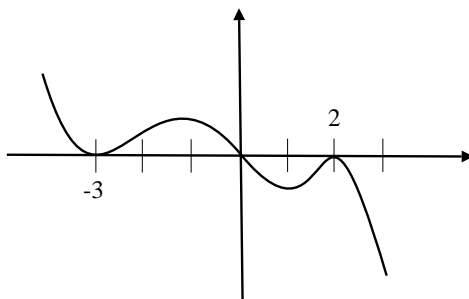
21. If $f(x) = \frac{x}{x-1}$ and $g(x) = \frac{-2}{x^2}$ then find $(f \circ g)(x)$ and simplify.

- (a) $(f \circ g)(x) = \frac{-2}{x^2-x}$
- (b) $(f \circ g)(x) = \frac{-2x^2}{(x-1)^2}$
- (c) $(f \circ g)(x) = \frac{-2(x-1)^2}{x^2}$
- (d) $(f \circ g)(x) = \frac{2}{x^2+2}$
- (e) $(f \circ g)(x) = 1$

22. Which of the following could be the graph of a polynomial whose **leading term** is $-3x^5$?



23. Identify the function whose graph resembles



(a) $f(x) = 2x(x - 3)^2(x + 2)^2$

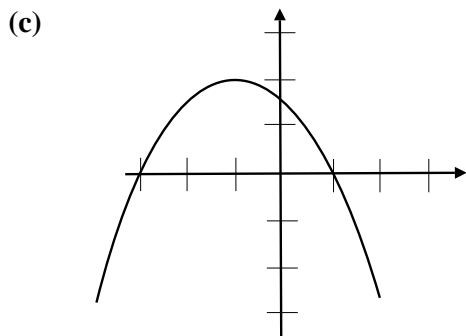
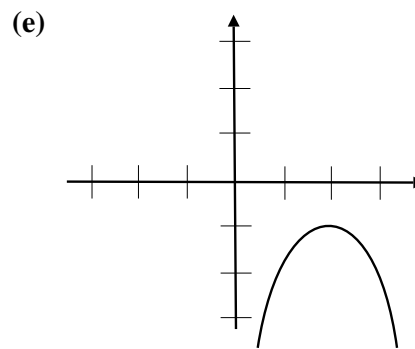
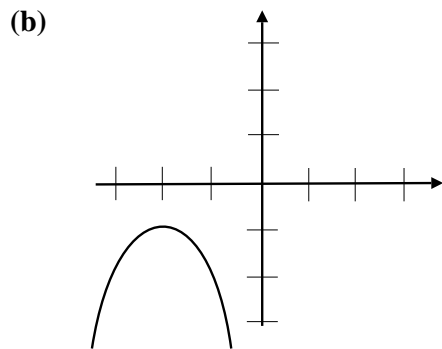
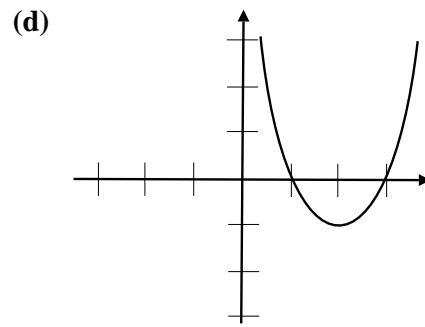
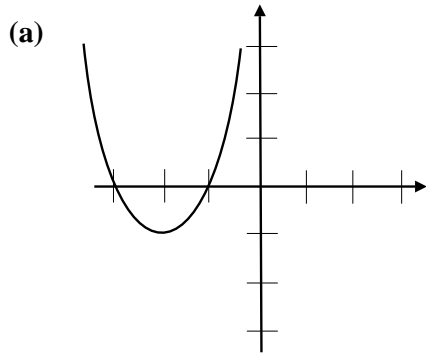
(b) $f(x) = 2x^2(x - 3)(x + 2)$

(c) $f(x) = -2x^2(x + 3)(x - 2)$

(d) $f(x) = -2x(x + 3)^2(x - 2)^2$

(e) $f(x) = 2x(x + 3)^2(x - 2)^2$

24. Identify the graph of $f(x) = -3(x - 2)^2 - 1$.



25. Let $f(x) = \frac{3x + 1}{x}$. Find $f^{-1}(x)$.

(a) $f^{-1}(x) = \frac{1}{x - 3}$

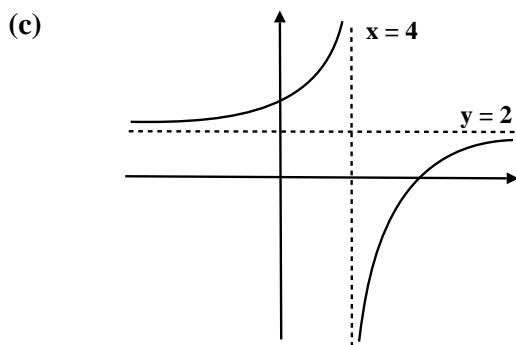
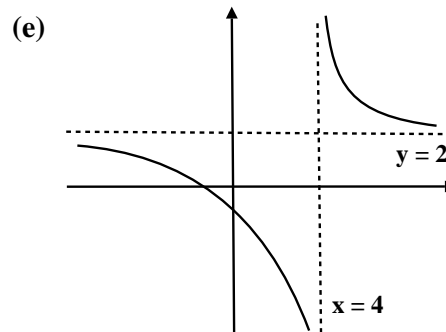
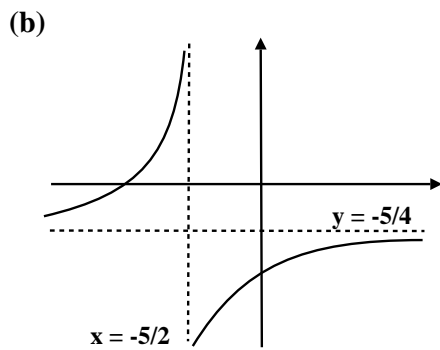
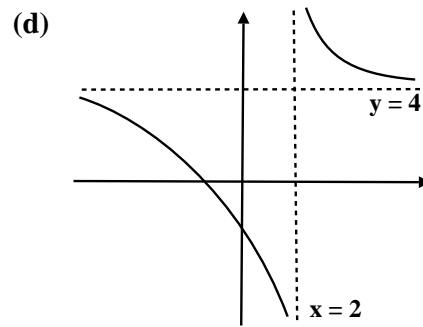
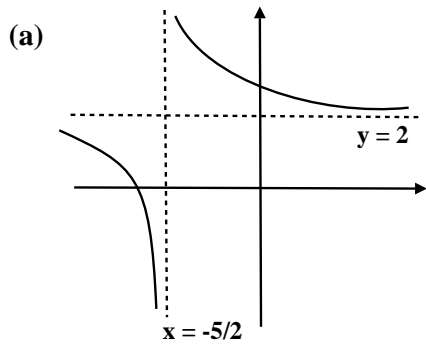
(d) $f^{-1}(x) = \frac{1}{x + 3}$

(b) $f^{-1}(x) = \frac{x}{3x + 1}$

(e) $f^{-1}(x) = \frac{x + 3}{x}$

(c) $f^{-1}(x) = \frac{3x + 1}{x}$

26. Identify the graph of $f(x) = \frac{2x + 5}{x - 4}$



27. On which intervals is the function $f(x) = -2(x - 2)(x + 5)^2$ positive?

(a) $(-\infty, -5)$ and $(2, \infty)$

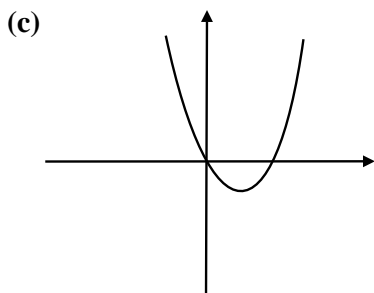
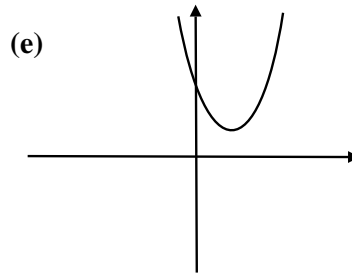
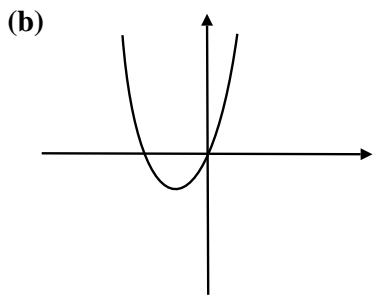
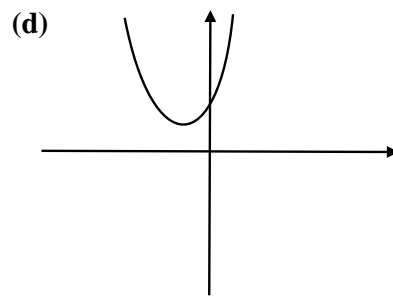
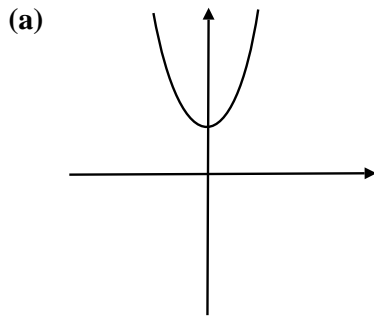
(d) $(-5, 2)$ only

(b) $(-\infty, -5)$ and $(-5, 2)$

(e) $(2, \infty)$ only

(c) $(-5, 2)$ and $(2, \infty)$

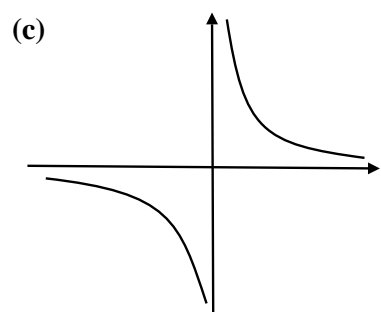
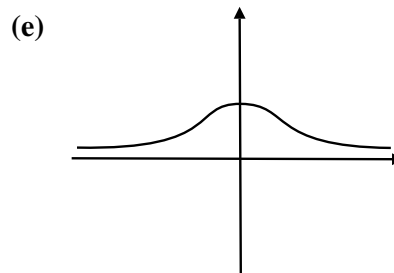
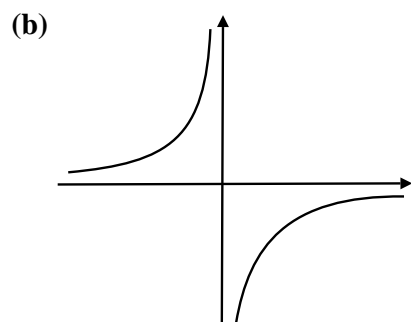
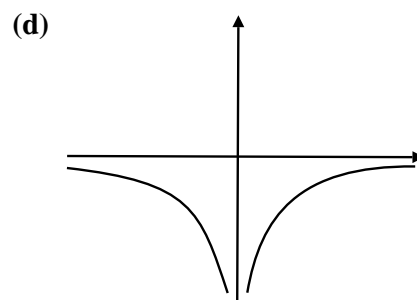
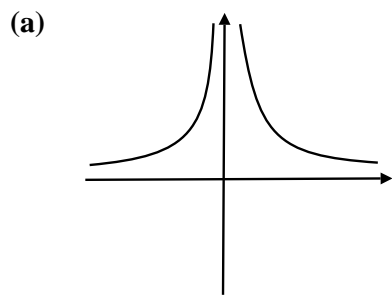
28. Which of the following is the graph of $f(x) = x^2 + 4x + 6$



29. Find the x -intercepts and vertical asymptotes of the graph of $f(x) = \frac{x^2 - 9}{x^2 + 2x - 8}$

- (a) x -intercepts $(-4, 0), (3, 0), (2, 0), (-3, 0)$ v.a. $x = -4, x = 3, x = 2, x = -3$
- (b) x -intercepts $(-4, 0), (2, 0)$ v.a. $x = 3, x = -3$
- (c) x -intercepts $(4, 0), (-2, 0)$ v.a. $x = 3, x = -3$
- (d) x -intercepts $(-3, 0), (3, 0)$ v.a. $x = 4, x = -2$
- (e) x -intercepts $(-3, 0), (3, 0)$ v.a. $x = -4, x = 2$

30. Which of the following resembles the graph of $f(x) = \frac{-3}{x^5}$



31. If f is an even function and (a, b) lies on the graph of f , what other point(s) must also lie on the graph of f ?

(a) $(-a, b)$

(d) $(a, -b)$ and $(-a, b)$

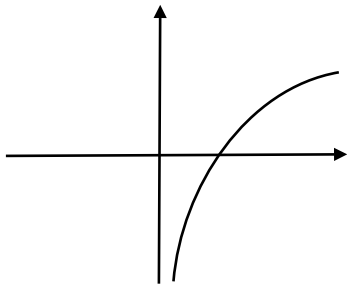
(b) $(a, -b)$

(e) $(a, -b)$ and $(-a, -b)$

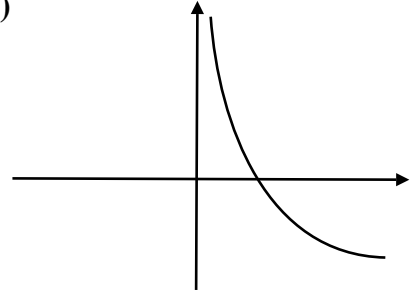
(c) $(-a, -b)$

32. Identify the graph of $y = \log_{1/2} x$.

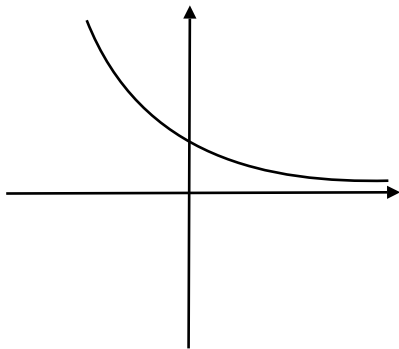
(a)



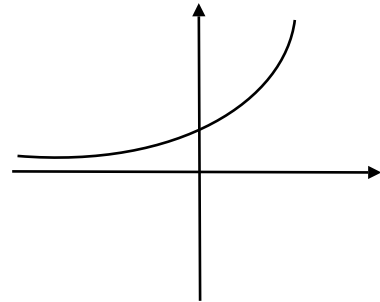
(d)



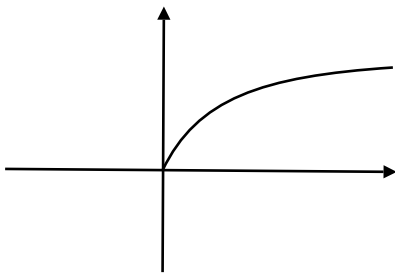
(b)



(e)



(c)



33. Find the solution set of the inequality $x^5 < 4x^3$.

(a) $\{x : -2 < x < 2\}$

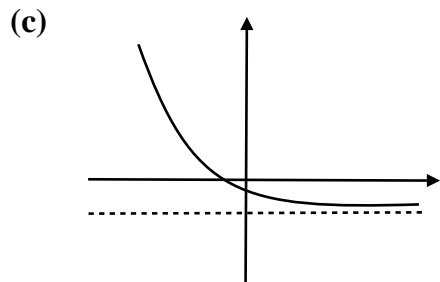
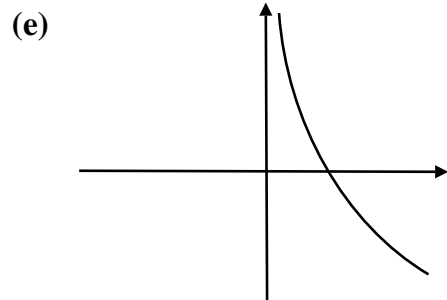
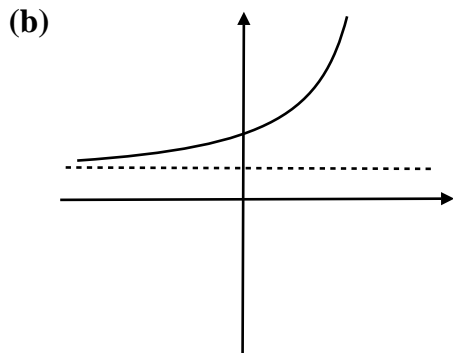
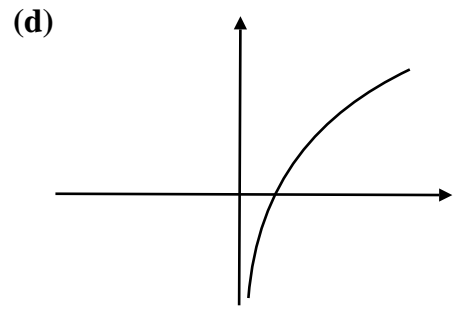
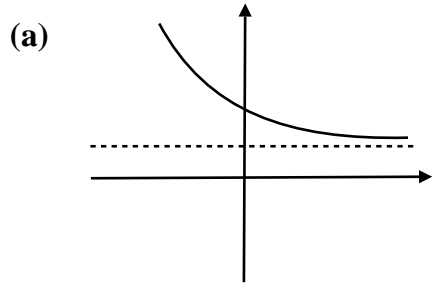
(d) $\{x : x < -2 \text{ or } 0 < x < 2\}$

(b) $\{x : -2 < x < 0 \text{ or } x > 2\}$

(e) $\{x : x < -2 \text{ or } x > 2\}$

(c) $\{x : x < 2\}$

34. Identify the graph of $y = e^{-x+5} + 2$.



35. Find the solution(s) of the equation $e^{3x+5} = 2$.

(a) -1

(d) $\frac{\ln 2 - 5}{3}$

(b) 1

(e) $\frac{\ln 0 + \ln 2 - 5}{3}$

(c) $\frac{-4 \ln 3}{3}$

36. Which statement is true of the equation $3^{2x} = 9^{x^2-6}$?

- (a) It has NO real solutions.
- (b) It has ONE real solution, which is POSITIVE.
- (c) It has ONE real solution, which is NEGATIVE.
- (d) It has TWO real solutions, whose SUM is 1.
- (e) It has TWO real solutions, whose SUM is -1 .

37. Find the expression that is equivalent to $\log_3 \left(\frac{3^x \sqrt{x^2 + 1}}{x^5} \right)$.

- (a) $x - 4 \log_3 x$
- (b) $x + \log_3(x + 1) - 5 \log_3 x$
- (c) $x + \frac{1}{2} \log_3(x^2 + 1) - 5 \log_3 x$
- (d) $x - \log_3 x + 2$
- (e) $x - \log_3 x$

38. Find the solution(s) of the equation $\log_{1/3}(3x + 2) = -2$.

- (a) $7/3$
- (b) -2
- (c) 3
- (d) $-2/3$
- (e) no solution

39. Find the domain of the function f defined by $f(x) = \log_4(3x - 5)$.

(a) $(0, \infty)$

(d) $(5/3, \infty)$

(b) $(2, \infty)$

(e) $\{x : x \neq 5/3\}$

(c) $(-\infty, 5/3)$

40. Find the solution set of the inequality $x + \frac{16}{x} < 8$.

(a) $(-\infty, 0)$

(d) $(4, \infty)$

(b) $(-\infty, 4)$

(e) $(0, 4)$

(c) $(0, \infty)$