

NO CALCULATORS, CELL PHONES, OR OTHER ELECTRONIC DEVICES MAY BE USED

Directions: Fill in the appropriate spaces on the scantron answer sheet.

1. Last name, first and middle initials

2. Student ID number

3. Section number

4. Form B

5. Sign the back

***** **FORM B** *****

1. [6 pts; R.4 Example 9] $(x + 2)^3 =$

(a) $x^3 + 8$

(d) $x^3 + 3x^2 + 3x + 8$

(b) $x^3 + 6x^2 + 12x + 8$

(e) None of these

(c) $x^3 - 6x^2 + 12x - 8$

2. [6 pts; 4.3 #13] The domain of the function $f(x) = \frac{-4x^2}{(x-2)(x+4)}$ is

(a) $\{x|x \neq -2, x \neq 4\}$

(d) $\{x|x \neq 2, x \neq -4, x \neq 0\}$

(b) $\{x|x \neq 2, x \neq -4\}$

(e) None of these

(c) $\{x|x \neq -2, x \neq 4, x \neq 0\}$

3. [6 pts; 4.3 #47] The graph of $f(x) = 4(x^2 + 1)(x - 2)^3$

(a) has one x -intercept, and touches the axis at this point

(b) has one x -intercept, and crosses the axis at this point

(c) has two x -intercepts, and touches the axis at each one

(d) has two x -intercepts, and crosses the axis at each one

(e) None of these

4. [6 pts; 2.4 #41] The equation of the line containing the points $(1, 3)$ and $(-1, 2)$ is

(a) $y = \frac{1}{2}x + \frac{5}{2}$

(b) $y = -\frac{1}{2}x + \frac{7}{2}$

(c) $y = 2x + 1$

(d) $y = -2x + 5$

(e) This is a vertical line, so there is no equation.

5. [6 pts; 4.6 #11] When $4x^3 - 3x^2 - 8x + 4$ is divided by $x - 2$ the remainder is

(a) 8

(b) 4

(c) 0

(d) -28

(e) None of these

6. [6 pts; 3.3 #57] The function $h(x) = \frac{-x^3}{3x^2 - 9}$ is

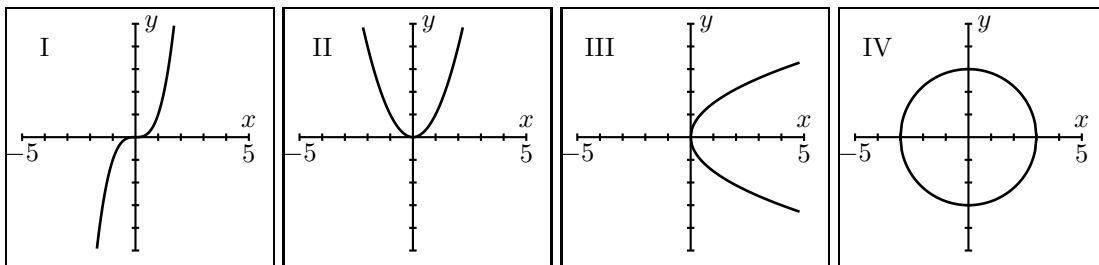
(a) Odd

(b) Even

(c) Neither even nor odd

7. [6 pts; 3.2 Example 1] Which of the following graphs are graphs of functions?

- (a) All (b) II (c) I, II (d) I, II, III (e) III, IV



8. [6 pts; 2.3 #27] The circle $x^2 + y^2 - 2x + 4y - 4 = 0$ has

- (a) center $(-1, 2)$ and radius 3 (d) center $(1, -2)$ and radius 9
 (b) center $(-1, 2)$ and radius 9 (e) center $(-2, 4)$ and radius 16
 (c) center $(1, -2)$ and radius 3

9. [6 pts; 2.5 #25] The equation of the line containing $(1, -2)$ and perpendicular to the line $y = \frac{1}{2}x + 4$ is

- (a) $y = 2x$ (d) $y = -2x - 4$
 (b) $y = -2x$ (e) None of these
 (c) $y = 2x + 4$

10. [6 pts; 3.5 #28] We get the following formula when these transformations are applied to the graph of $y = \sqrt{x}$:

(1) reflect about the x -axis; (2) shift right 3 units; (3) shift down 2 units.

- (a) $y = \sqrt{-x - 2} - 3$ (d) $y = \sqrt{-x - 3} - 2$
 (b) $y = -\sqrt{x - 2} - 3$ (e) None of these
 (c) $y = -\sqrt{x - 3} - 2$

11. [6 pts; 1.1 Example 6] The solution to the equation $\frac{3x}{x-1} + 2 = \frac{3}{x-1}$ is

- (a) $x = 1$
 (b) $x = 5$
 (c) $x = \frac{1}{5}$
 (d) There is no solution
 (e) None of these

12. [6 pts; 1.5 #75] The solution to the inequality $1 < 1 - \frac{1}{2}x < 4$ is

- (a) $[0, 6]$ (d) $(0, 6)$
 (b) $[-6, 0]$ (e) None of these
 (c) $(-6, 0)$

13. [6 pts; R.5 #121] $2x(x+3)(x-2)^3 + 3(x+3)^2(x-2)^2 =$

- (a) $5(x+3)^3(x-2)^5$
 (b) $5(x+3)^2(x-2)^3$
 (c) $5(x+3)(x-2)^2(x+1)$
 (d) $-(x+3)(x-2)^2(x+13)$
 (e) None of these

14. [6 pts; R.5 p44] $x^3 + a^3$ can be factored as

- (a) $(x - a)(x^2 - ax + a^2)$ (d) $(x + a)(x^2 - ax + a^2)$
(b) $(x - a)(x^2 + ax + a^2)$ (e) None of these
(c) $(x + a)(x^2 + ax + a^2)$

15. [6 pts; 5.1 #19] If $f(x) = \frac{3}{x-1}$ and $g(x) = \frac{2}{x}$, then the composite function $f \circ g$ is

- (a) $\frac{2}{3}(x - 1)$ with domain $\{x|x \neq 1\}$
(b) $\frac{2}{3}(x - 1)$ with domain all real numbers
(c) $\frac{3x}{x-2}$ with domain $\{x|x \neq 2\}$
(d) $\frac{3x}{x-2}$ with domain $\{x|x \neq 0, x \neq 2\}$
(e) None of these

16. [6 pts; 5.2 #55] The inverse of the function $f(x) = \frac{2x}{3x-1}$ is

- (a) $f^{-1}(x) = \frac{3x-1}{2x}$ (d) $f^{-1}(x) = \frac{3x}{x-2}$
(b) $f^{-1}(x) = \frac{x}{3x+2}$ (e) None of these
(c) $f^{-1}(x) = \frac{x}{3x-2}$

17. [6 pts; 5.4 p437] Which answer describes the graph of the logarithmic function $f(x) = \ln x$?

- (a) The graph goes through $(0, 1)$ and has $x = 0$ as a vertical asymptote.
(b) The graph goes through $(1, 0)$ and has $x = 0$ as a vertical asymptote.
(c) The graph goes through $(0, 1)$ and has $y = 0$ as a horizontal asymptote.
(d) The graph goes through $(1, 0)$ and has $y = 0$ as a horizontal asymptote.
(e) The graph is a straight line through $(0, 1)$ and $(e, 1)$.

18. [6 pts; 5.3 p416] Which answer describes the graph of the exponential function $f(x) = e^x$?

- (a) The graph goes through $(0, e)$ and increases as x increases.
(b) The graph goes through $(0, e)$ and decreases as x increases.
(c) The graph goes through $(0, 1)$ and increases as x increases.
(d) The graph goes through $(0, 1)$ and decreases as x increases.
(e) The graph is a straight line through $(1, e)$.

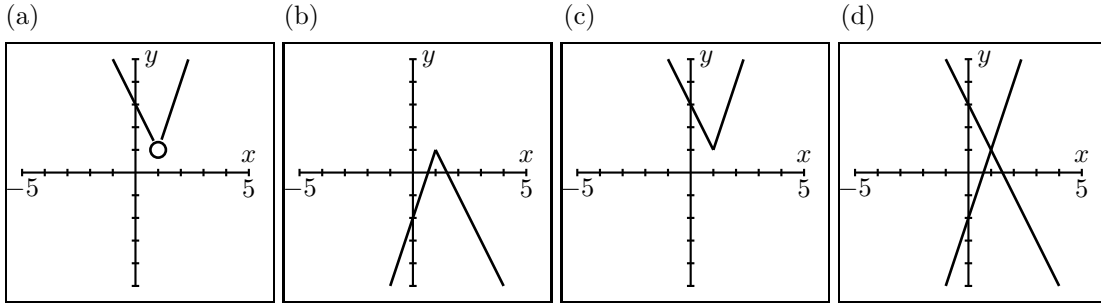
19. [6 pts; 5.3 #65] The equation $e^{x^2} = (e^{3x}) \cdot \frac{1}{e^2}$ has

- (a) no real solution
(b) one real solution, $x = 1$
(c) two real solutions whose product is 2
(d) two real solutions whose product is -2
(e) None of these

20. [6 pts; 5.4 p431] If $f(x) = \log_5(x)$, then its inverse function is

- (a) $f^{-1}(x) = -\log_5(x)$ (d) $f^{-1}(x) = 5^x$
 (b) $f^{-1}(x) = \frac{1}{\log_5(x)}$ (e) f^{-1} does not exist
 (c) $f^{-1}(x) = \log_{\frac{1}{5}}(x)$

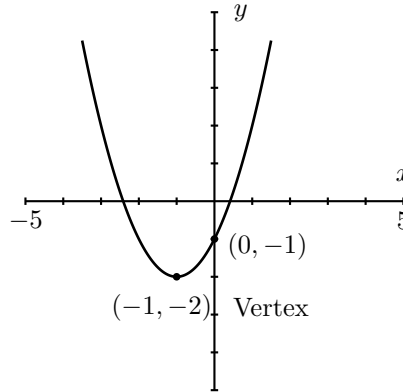
21. [5 pts; 3.4 #31] The graph of the function $f(x) = \begin{cases} -2x + 3 & \text{if } x < 1 \\ 3x - 2 & \text{if } x \geq 1 \end{cases}$ is



(e) None of these

22. [5 pts; 4.1 #53] The quadratic function whose graph is given is

- (a) $f(x) = x^2 - 2x + 1$
 (b) $f(x) = x^2 - x + 2$
 (c) $f(x) = x^2 + 2x + 1$
 (d) $f(x) = x^2 + 2x - 1$
 (e) None of these



23. [5 pts; 1.6 #39] The solution to the inequality $|x - 3| \geq 2$ is

- (a) $\{x \mid x \leq -1 \text{ or } x \geq 5\}$ (d) $\{x \mid -1 \leq x \leq 5\}$
 (b) $\{x \mid x \leq 1 \text{ or } x \geq 5\}$ (e) None of these
 (c) $\{x \mid 1 \leq x \leq 5\}$

24. [5 pts; 4.5 #31] The inequality $\frac{x+1}{x-1} > 0$ has the solution set

- (a) $\{x \mid x < -1 \text{ or } x > 1\}$ (d) $\{x \mid -1 \leq x \leq 1\}$
 (b) $\{x \mid x < 1 \text{ or } x > 2\}$ (e) None of these
 (c) $\{x \mid -1 < x < 1\}$

25. [5 pts; 4.3 #50] The rational function $f(x) = \frac{6x^2 + x + 12}{3x^2 - 5x - 2}$ has the following asymptotes:

- (a) $y = 2$; $x = -\frac{1}{3}$; $x = 2$ (d) $x = 2$; $y = \frac{1}{3}$; $y = -2$
 (b) $y = 2$; $x = \frac{1}{3}$; $x = -2$ (e) None of these
 (c) $x = 2$; $y = -\frac{1}{3}$; $y = 2$

26. [5 pts; 1.4 #28] The solution to the equation $\sqrt{3x+7} + \sqrt{x+2} = 1$ is
- $x = -1$
 - $x = -2$
 - $x = -1$ or $x = -2$
 - There is no solution
 - None of these
27. [5 pts; R.7 #45] After simplifying, the *numerator* of $\frac{4}{x-1} - \frac{2}{x+2}$ is
- 2
 - 8
 - $2x + 6$
 - $2x - 8$
 - None of these
28. [5 pts; 5.1] If $f(x) = \frac{1}{2x-1}$ and $g(x) = \frac{1}{x+1}$, then the domain of the composite function $f \circ g$ is
- $\{x \mid x \neq 1\}$
 - $\{x \mid x \neq -1\}$
 - $\{x \mid x \neq 1 \text{ and } x \neq -1\}$
 - $\{x \mid x \neq 1/2\}$
 - None of these
29. [5 pts; 3.1 #77] For $f(x) = x^3 - 2$, the difference quotient $\frac{f(x+h) - f(x)}{h}$ is
- $x^2 + xh + h^2$
 - $3x^2 + 3xh + h^2$
 - $3x^2 + 3xh^2 + h^3$
 - h^2
 - None of these
30. [5 pts; 3.6 #5] The price p and the quantity x sold of a certain product obey the demand equation $x = -5p + 100$. If 10 units are sold, then the revenue is
- \$18
 - \$50
 - \$180
 - \$255
 - None of these
31. [5 pts; R.8 Example 7c] $\left(\frac{9x^2y^{1/3}}{x^{1/3}y}\right)^{1/2} =$
- $3x$
 - $\frac{3x^{5/6}}{y^{1/3}}$
 - $\frac{3x^{9/5}}{y^{1/3}}$
 - $\frac{9x^{9/5}}{y^{1/3}}$
 - None of these

32. [5 pts; 5.6 #37] The solution to the equation $\log_{16} x + \log_4 x + \log_2 x = 7$ is
- (a) $x = 16$
 - (b) $x = 8$
 - (c) $x = 4$
 - (d) There is no real solution
 - (e) None of these
33. [5 pts; R.7 p69 #76] After simplifying, the *denominator* of $\frac{1 - \frac{x}{x+1}}{2 - \frac{x-1}{x}}$ is
- (a) $x + 1$
 - (b) $x^2 - 1$
 - (c) $(x - 1)^2$
 - (d) $(x + 1)^2$
 - (e) None of these
34. [5 pts; 1.2 #97] An open box is to be constructed from a square piece of sheet metal by removing a square of side 1 foot from each corner and turning up the edges. If the box is to hold 4 cubic feet, then the dimensions of the sheet metal should be
- (a) 1 foot by 1 foot
 - (b) 2 feet by 2 feet
 - (c) 4 feet by 4 feet
 - (d) 8 feet by 8 feet
 - (e) None of these
35. [5 pts; 1.7 #27] A motorboat maintains a constant speed of 15 miles per hour relative to the water in going 10 miles upstream and then returning. If the total time for the trip is 1.5 hours, then the speed of the current must be
- (a) 2 miles per hour
 - (b) 4 miles per hour
 - (c) 5 miles per hour
 - (d) 10 miles per hour
 - (e) None of these
36. [5 pts; 4.1 #71] If the price p and the quantity x sold of a certain product obey the demand equation $p = -\frac{1}{6}x + 100$, for $0 \leq x \leq 600$, then in order to maximize revenue the unit price that the company should charge is
- (a) \$50
 - (b) \$100
 - (c) \$300
 - (d) \$600
 - (e) None of these

Key	FORM B	FINAL EXAM	SPRING 2005
1 (b)	7 (c)	14 (d)	20 (d) 26 (b) 32 (a)
2 (b)	8 (c)	15 (e)	21 (c) 27 (e) 33 (d)
3 (b)	9 (b)	16 (c)	22 (d) 28 (c) 34 (c)
4 (a)	10 (c)	17 (b)	23 (b) 29 (b) 35 (c)
5 (a)	11 (d)	18 (c)	24 (a) 30 (c) 36 (a)
6 (a)	12 (c)	19 (c)	25 (a) 31 (b)
	13 (e)		

SOLUTIONS

The full solutions to all but problems 10, 25, 26, 28 and 33 can be found either in the text or in the student solutions manual.

10. Begin with the graph of $y = \sqrt{x}$. The first transformation is to reflect about the x -axis, which means that we must change the sign of y , and so we get (1) $y = -\sqrt{x}$. The next transformation is to shift right 3 units, so we need to substitute $x - 3$ for x , which gives us (2) $y = -\sqrt{x - 3}$. The final transformation is to shift down 2 units, so we need to subtract 2, giving us the final answer (3) $y = -\sqrt{x - 3} - 2$.

25. The rational function $f(x) = \frac{6x^2 + x + 12}{3x^2 - 5x - 2}$ has the following asymptotes.

To find the horizontal asymptote (if any), we ignore all but the highest powers of x . The function behaves like $y = \frac{6x^2}{3x^2} = 2$ when $|x|$ is large, so there *is* a horizontal asymptote: $y = 2$.

To find the vertical asymptotes (if any), set the denominator equal to zero. It can be factored: $(3x+1)(x-2) = 0$, so we have vertical asymptotes $x = -\frac{1}{3}$ and $x = 2$.

26. The solution to the equation $\sqrt{3x+7} + \sqrt{x+2} = 1$ is:

$$\begin{aligned} \sqrt{3x+7} &= 1 - \sqrt{x+2} && \text{Now square both sides} && 3x+7 &= 1 - 2\sqrt{x+2} + (x+2) && \text{Combine terms} \\ 2x+4 &= -2\sqrt{x+2} && \text{Divide by 2} && x+2 &= -\sqrt{x+2} && \text{Square both sides} && x^2+4x+4 = x+2 \\ x^2+3x+2 &= 0 && (x+2)(x+1) &= 0 && x &= -2 \text{ or } x = -1 \end{aligned}$$

Now be very careful: you **must** check your answers in the original equation, because the equation has been squared twice, and this can possibly introduce a false solution. If $x = -2$, we get $\sqrt{-6+7} + \sqrt{-2+2} = \sqrt{1} + \sqrt{0} = 1$. If $x = -1$, we get $\sqrt{-3+7} + \sqrt{-1+2} = \sqrt{4} + \sqrt{1} = 3$. The correct answer is $x = -2$.

28. If $f(x) = \frac{1}{2x-1}$ and $g(x) = \frac{1}{x+1}$, then the domain of the composite function $f \circ g$ is:

$$f(g(x)) = \frac{1}{2\left(\frac{1}{x+1}\right) - 1} = \frac{x+1}{2 - (x+1)} = \frac{x+1}{1-x} \quad (\text{Simplify by multiplying the numerator and denominator of the fraction by } x+1.)$$

From the first substitution we can see that we must exclude $x = -1$ and from the simplified form we can see that we must exclude $x = 1$.

33. After simplifying, the *denominator* of $\frac{1 - \frac{x}{x+1}}{2 - \frac{x-1}{x}}$ is:

Begin by adding the terms in the numerator and in the denominator (separately). To do this you need to find a common denominator in both places. To divide fractions, you invert the bottom one and multiply.

$$\frac{1 - \frac{x}{x+1}}{2 - \frac{x-1}{x}} = \frac{\frac{x+1}{x+1} - \frac{x}{x+1}}{\frac{2x}{x} - \frac{x-1}{x}} = \frac{\frac{1}{x+1}}{\frac{2x-x+1}{x}} = \frac{1}{x+1} = \frac{1}{x+1} \cdot \frac{x}{x+1} = \frac{x}{(x+1)^2}$$