

(40 minutes)

1. If $(a^3b^{-2})^{-2}$ is simplified to a form in which all exponents are positive, the result is
 - (a) $\frac{b^4}{a^4}$
 - (b) $\frac{1}{a^2b}$
 - (c) $\frac{a^6}{b^4}$
 - (d) a^2b
 - (e) $\frac{1}{b^4}$

2. If $\log x + \log 8 = \log 16$ then $x =$
 - (a) 2
 - (b) 4
 - (c) 8
 - (d) $1/8$
 - (e) $1/2$

3. Which of the following functions is its own inverse? I. $f(x) = x$, II. $f(x) = -x$, III. $f(x) = x + 1$
 - (a) I only
 - (b) II only
 - (c) I and II only
 - (d) II and III only
 - (e) I, II, and III

4. If $\log_2 5 = M$, then $\log_2 10 =$
 - (a) 1
 - (b) $2M$
 - (c) $1/M$
 - (d) $1 + M$
 - (e) $M - 1$

5. If $3^{x+y} = 1/3$ and $2^{x-y} = 1$, which of the following is (x, y) ?
 - (a) $(-1, -1/2)$
 - (b) $(-1/2, -1/2)$
 - (c) $(-1, 0)$
 - (d) $(0, -1)$
 - (e) $(1/2, 1/2)$

6. If $-2 \leq x \leq 4$, and $f(x) = |x^2 - 9|$, then what is the range of f ?
- (a) $y \geq 0$
 - (b) $0 \leq y \leq 7$
 - (c) $5 \leq y \leq 7$
 - (d) $0 \leq y \leq 9$
 - (e) $y \leq 9$
7. If $f(x) = f^{-1}(x)$ for all real numbers x , what might $f(x)$ equal?
- (a) x
 - (b) x^2
 - (c) $x + 1$
 - (d) $2x$
 - (e) $2x^2$
8. For all θ , $(\pi^{\cos(\theta)})^{\pi^{-\cos \theta}} =$
- (a) 1
 - (b) $\pi^{2 \cos(-\theta)}$
 - (c) $\pi^{-2 \cos \theta}$
 - (d) $\pi^{-2 \cos(-\theta)}$
 - (e) $\pi^{\cos 2\theta}$
9. If $36x^4 - 126x^2 + 108 = 0$, which of the following is *not* a valid value of x :
- (a) -1.41
 - (b) -1.22
 - (c) 0
 - (d) 1.22
 - (e) 1.41
10. f is a function. Suppose the following two statements are true of f : I. f has a root at $x = 2$. II. The graph of $y = f(x)$ has exactly two asymptotes, at $x = -1$ and $y = 1$. Which of the following functions could be f ?
- (a) $f(x) = \frac{x-1}{x+1}$
 - (b) $f(x) = (x-1)(x+2)$
 - (c) $f(x) = (x-2)(x+1)$
 - (d) $f(x) = \frac{x-2}{x+1}$
 - (e) $f(x) = \frac{(x-2)(x-1)}{x+1}$

11. $f(x) = x^3 + 2x^2 - 8x$. For what values of x is $f(x) \geq 0$?
- (a) $x \geq 2$
 - (b) $x \leq 0$
 - (c) $0 \leq x \leq 2$ and $x \geq 5$
 - (d) $-4 \leq x \leq 0$ and $x \geq 2$
 - (e) $-4 \leq x \leq 2$
12. $f(x) = \begin{cases} e^x + 1 & \text{if } x \geq 0 \\ -x^2 + 2 & \text{if } x < 0 \end{cases}$. What is the range of f ?
- (a) $y \geq 1$
 - (b) $y \geq 2$
 - (c) $y > 0$
 - (d) $y < 0$
 - (e) All real numbers.
13. For what value(s) of x is the inverse of $f(x) = \frac{1}{x^3}$ *not* defined?
- (a) $x \leq 0$
 - (b) $x < 0$
 - (c) $x = 0$ only
 - (d) $x > 0$
 - (e) $x \geq 0$
14. If a and b are nonzero real numbers and $(3.92)^a = (7.86)^b$, what is the value of $\left(\frac{b}{a}\right)^2$?
- (a) 0.44
 - (b) 0.66
 - (c) 0.90
 - (d) 1.5
 - (e) 2.3
15. If $f^{-1}(x) = 11x^2$ for $x > 0$, then $f(2) =$
- (a) 0.18
 - (b) 0.43
 - (c) 0.60
 - (d) 22
 - (e) 44

16. For what values of x and y is $|x - y| \leq |y - x|$?
- (a) $x < y$
 - (b) $y < x$
 - (c) $x > 0$ and $y < 0$
 - (d) for no values of x and y
 - (e) for all values of x and y
17. If $f(x) = x - 1$, $g(x) = 3x$, and $h(x) = 5/x$, then $f^{-1}(g(h(5))) =$
- (a) 4
 - (b) 2
 - (c) $5/6$
 - (d) $1/2$
 - (e) $5/12$
18. If $f(x) = x^3 - 5$, then the inverse of $f =$
- (a) $-x^3 + 4$
 - (b) $\sqrt[3]{x + 4}$
 - (c) $\sqrt[3]{x - 4}$
 - (d) $\frac{1}{x^3 - 4}$
 - (e) $\frac{4}{\sqrt[3]{x}}$
19. If $f(x) = \frac{x+2}{(x-2)(x^2-4)}$, its graph will have
- (a) one horizontal and three vertical asymptotes
 - (b) one horizontal and two vertical asymptotes
 - (c) one horizontal and one vertical asymptote
 - (d) zero horizontal and one vertical asymptote
 - (e) zero horizontal and two vertical asymptotes
20. If $7^{x-1} = 6^x$, find x .
- (a) -13.2
 - (b) 0.08
 - (c) 0.22
 - (d) 0.52
 - (e) 12.6

21. If $(\log_3 x)(\log_5 3) = 3$, find x .

- (a) 5
- (b) 9
- (c) 25
- (d) 81
- (e) 125

22. If $f(x) = 2^{3x-5}$, find $f^{-1}(16)$.

- (a) 1
- (b) 2
- (c) 3
- (d) 4
- (e) 5

23. If $5.21^p = 2.86^q$, what is the value of $\frac{p}{q}$?

- (a) -0.6
- (b) 0.55
- (c) 0.60
- (d) 0.64
- (e) 1.57

24. If x and y are real numbers and $i = \sqrt{-1}$, find the ordered pair solution for the equation $3yi + 2i^3 = 7i + 6i^6 + 3x$

- (a) $(0, 7/3)$
- (b) $-3, 3$
- (c) $2, 3$
- (d) $3/2, 3/7$
- (e) $3, 2$

25. If $f(x) = 2^x + 1$, then $f^{-1}(7) =$

- (a) 2.4
- (b) 2.6
- (c) 2.8
- (d) 3
- (e) 3.6

26. If $f(x) = \frac{3}{x-2}$ and $g(x) = \sqrt{x+1}$, find the domain of $f \circ g$.
- (a) $x \geq -1$
 - (b) $x \neq 2$
 - (c) $x \geq -1, x \neq 2$
 - (d) $x \geq -1, x \neq 3$
 - (e) $x \leq -1$
27. What is the domain of the function $f(x) = \log \sqrt{2x^2 - 15}$
- (a) $-7.5 < x < 7.5$
 - (b) $x < -7.5$ or $x > 7.5$
 - (c) $x < -2.7$ or $x > 2.7$
 - (d) $x < -3.2$ or $x > 3.2$
 - (e) $x < 1.9$ or $x > 1.9$
28. If $f(x) = x \log x$ and $g(x) = 10^x$, the $g(f(2)) =$
- (a) 24
 - (b) 17
 - (c) 4
 - (d) 2
 - (e) 0.6
29. How many positive integer solutions are there in the solution set of $\frac{x}{x-2} > 5$
- (a) 0
 - (b) 2
 - (c) 4
 - (d) 5
 - (e) an infinite number