

Math Subject Test – Level 2 (harder) ~ Example 2

1. If $1 - \frac{1}{x} = 3 - \frac{3}{x}$, then $1 - \frac{1}{x} =$

- (A) $-\frac{1}{2}$ (B) 0 (C) $\frac{1}{2}$ (D) $\frac{2}{3}$ (E) 3

L2T2_1

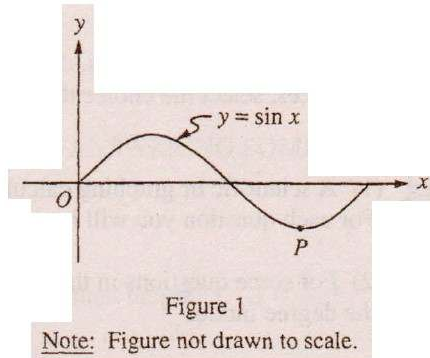
2. $a\left(\frac{1}{b} + \frac{1}{c}\right) =$

- (A) $\frac{a}{bc}$
 (B) $\frac{a}{b+c}$
 (C) $\frac{2a}{b+c}$
 (D) $\frac{ab+ac}{bc}$
 (E) $\frac{1}{ab+ac}$

L2T2_2

3. Figure 1 shows one cycle of the graph of the function $y = \sin x$ for $0 \leq x \leq 2\pi$. If the minimum value of the function occurs at point P , then the coordinates of P are

- (A) $\left(\frac{4\pi}{3}, -\pi\right)$
 (B) $\left(\frac{4\pi}{3}, -1\right)$
 (C) $\left(\frac{3\pi}{2}, -\pi\right)$
 (D) $\left(\frac{3\pi}{2}, -1\right)$
 (E) $\left(\frac{3\pi}{2}, 0\right)$



L2T2_3

4. If P and Q are different points in a plane, the set of all points in this plane that are closer to P than to Q is

- (A) the region of the plane on one side of a line
 (B) the interior of a square
 (C) a wedge-shaped region of the plane
 (D) the region of the plane bounded by a parabola
 (E) the interior of a circle

L2T2_4

5. If $\sqrt{6y} = 4.73$, then $y =$

- (A) 0.62 (B) 1.93 (C) 3.73 (D) 5.33 (E) 11.59

L2T2_5

6. In Figure 2, $r \cos \theta =$

- (A) x
 (B) y
 (C) r
 (D) $x + y$
 (E) $r + y$

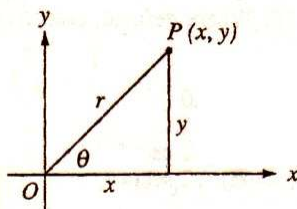


Figure 2

L2T2_6

7. If $f(x) = \sqrt{0.3x^2 - x}$ and $g(x) = \frac{x+1}{x-1}$, then $g(f(10)) =$

- (A) 0.2 (B) 1.2 (C) 1.6 (D) 4.5 (E) 5.5

L2T2_7

8. If n , p , and t are nonzero real numbers and if

$$n^4 p^7 t^9 = \frac{4n^3 p^7}{t^{-9}}, \text{ then } n =$$

- (A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) 4 (D) $4p^2 t^2$ (E) $4p^{18} t^{18}$

L2T2_8

9. In the triangle in Figure 3, if $OA = AB$, what is the slope of segment AB ?

- (A) $\sqrt{2}$
 (B) $\frac{\sqrt{2}}{2}$
 (C) $-\frac{\sqrt{2}}{2}$
 (D) $-\sqrt{2}$

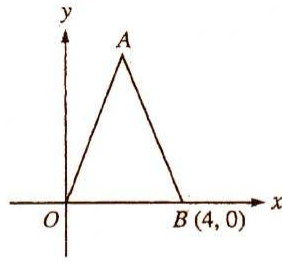


Figure 3

(E) It cannot be determined from the information given.

L2T2_9

10. Where defined, $\csc(2\theta) \sin(2\theta) =$

- (A) 1
 (B) 0
 (C) -1
 (D) $2 \csc(4\theta)$
 (E) $2 \sec(4\theta)$

L2T2_10

11. The graph of $y = f(x)$ is shown in Figure 4. Which of the following could be the graph of $y = |f(x)|$?

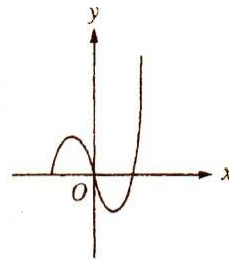
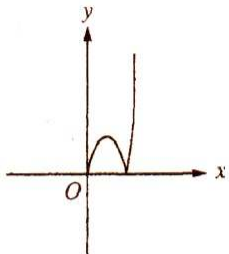
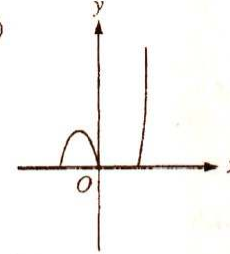
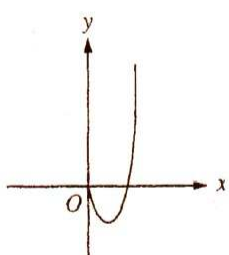
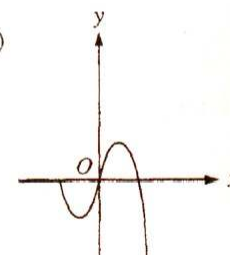
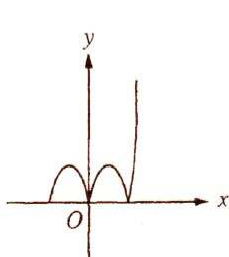


Figure 4

- (A) 
- (B) 
- (C) 
- (D) 
- (E) 

L2T2_11

12. If 3 and -2 are both zeros of the polynomial $p(x)$, then a factor of $p(x)$ is

- (A) $x^2 - 6$
- (B) $x^2 - x - 6$
- (C) $x^2 + 6$
- (D) $x^2 + x - 6$
- (E) $x^2 + x + 6$

L2T2_12

13. A kite string is attached to a peg in the ground. If 100 meters of kite string are played out on the kite and the string makes an angle of 49° with the ground, what is the distance, in meters, from the kite to the ground? (Assume that the string is taut and the ground is level.)

- (A) 133
- (B) 115
- (C) 75
- (D) 66
- (E) 52

L2T2_13

14. If $f(x) = 3x + 5$ and $f(g(1)) = 11$, which of the following could be $g(x)$?

- (A) $7x - 5$
- (B) $5x + 7$
- (C) $5x - 7$
- (D) $5x + 3$
- (E) $-5x + 3$

L2T2_14

15. Figure 5 shows a cube with edge of length 3 centimeters. If points A and C are midpoints of the edges of the cube, what is the perimeter of region $ABCD$?

- (A) 6.71 cm
- (B) 11.25 cm
- (C) 13.42 cm
- (D) 22.50 cm
- (E) 45.00 cm

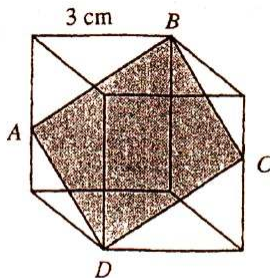


Figure 5

L2T2_15

16. An equation of line ℓ in Figure 6 is

- (A) $x = 2$
- (B) $y = 2$
- (C) $x = 0$
- (D) $y = x + 2$
- (E) $x + y = 2$

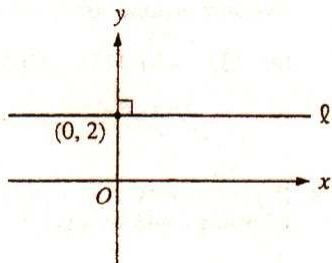


Figure 6

L2T2_16

17. The mean weight of the 19 members of an algebra class was 112 pounds. When a new student enrolled, the mean decreased to 111 pounds. What was the weight, in pounds, of the new student?

- (A) 91
- (B) 92
- (C) 93
- (D) 101
- (E) 110

L2T2_17

18. If $0 < x < \pi$ and $\cos x = 0.875$, what is the value of

$$\tan\left(\frac{x}{2}\right)?$$

- (A) 0.008
- (B) 0.017
- (C) 0.258
- (D) 0.277
- (E) 0.553

L2T2_18

19. Recently 30,744 residents of Lyon County and 20,496 residents of Saline County voted on a referendum. A total of 38,430 residents of the two counties voted yes. If the same percentage of the voters in each county voted yes, how many of the residents of Lyon County voted yes?

- (A) 7,686
- (B) 10,248
- (C) 15,372
- (D) 17,934
- (E) 23,058

L2T2_19

20. If $f: (x, y) \rightarrow (x + 2y, y)$ for every pair (x, y) in the plane, for what points (x, y) is it true that $(x, y) \rightarrow (x, y)$?

- (A) The set of points (x, y) such that $x = 0$
- (B) The set of points (x, y) such that $y = 0$
- (C) The set of points (x, y) such that $y = 1$
- (D) $(0, 0)$ only
- (E) $(-1, 1)$ only

L2T2_20

21. What number should be added to each of the three numbers 1, 7, and 19 so that the resulting three numbers form a geometric progression?

- (A) 2
- (B) 3
- (C) 4
- (D) 5
- (E) 6

L2T2_21

22. If $f(x) = ax^2 + bx + c$ for all real numbers x and if $f(0) = 1$ and $f(1) = 2$, then $a + b =$

- (A) -2
- (B) -1
- (C) 0
- (D) 1
- (E) 2

L2T2_22

23. What is the degree measure of the largest angle of a triangle that has sides of length 7, 6, and 6?

- (A) 31.00°
- (B) 54.31°
- (C) 71.37°
- (D) 125.69°
- (E) 144.31°

L2T2_23

24. What is the domain of $f(x) = \sqrt[3]{-x^2 + 13}$?

- (A) $x > 0$
- (B) $x > 2.35$
- (C) $-2.35 < x < 2.35$
- (D) $-3.61 < x < 3.61$
- (E) All real numbers

L2T2_24

25. If $\cos x = \tan x$, which of the following is a possible radian value of x ?

- (A) -1.00
- (B) -0.52
- (C) 0.00
- (D) 0.52
- (E) 0.67

L2T2_25

26. Figure 7 shows a portion of the graph of $y = 3^x$. What is the sum of the areas of the three inscribed rectangles shown?

(A) 4,698 (B) 1,638 (C) 819 (D) 182 (E) 91

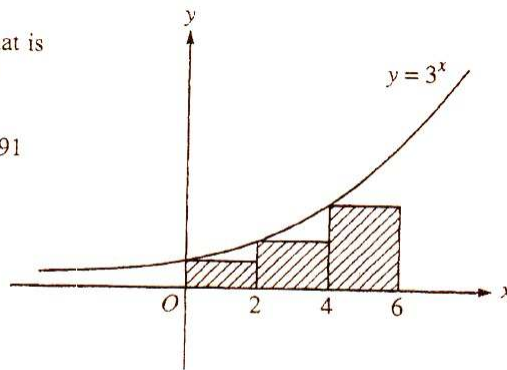


Figure 7

Note: Figure not drawn to scale.

L2T2_26

27. When a certain radioactive element decays, the amount that exists at any time t can be calculated by the function $E(t) = ae^{\frac{-t}{1000}}$, where a is the initial amount and t is the elapsed time in years. How many years would it take for an initial amount of 600 milligrams of this element to decay to 300 milligrams?

(A) 0.5
 (B) 500
 (C) 693
 (D) 1,443
 (E) 5,704

L2T2_27

28. Which of the following lines are asymptotes of the graph of $y = \frac{1+x}{x}$?

I. $x = 0$
 II. $y = 0$
 III. $y = 1$

(A) I only
 (B) II only
 (C) I and II only
 (D) I and III only
 (E) I, II, and III

L2T2_28

29. If $f(2x + 1) = 2x - 1$ for all real numbers x , then $f(x) =$

(A) $-x + 1$
 (B) $x - 1$
 (C) $x - 2$
 (D) $2x - 1$
 (E) $\frac{1}{2}x - 1$

L2T2_29

30. Which of the following could be the coordinates of the center of a circle tangent to the x -axis and the y -axis?

(A) $(-1, 0)$
 (B) $(-1, 2)$
 (C) $(0, 2)$
 (D) $(2, -2)$
 (E) $(2, 1)$

L2T2_30

31. What is the range of the function defined by

$$f(x) = \begin{cases} x^{\frac{1}{3}}, & x > 2 \\ 2x - 1, & x \leq 2 \end{cases} ?$$

- (A) $y > 2^{\frac{1}{3}}$
(B) $y \leq 3$
(C) $2^{\frac{1}{3}} < y < 3$
(D) $y \geq 3$
(E) All real numbers

L2T2_31

32. If $3x - 4y + 7 = 0$ and $2y - x^2 = 0$ for $x \geq 0$, then $x =$

- (A) 1.27
(B) 2.07
(C) 2.77
(D) 4.15
(E) 5.53

L2T2_32

33. If $f(x) = \log_2 x$ for $x > 0$, then $f^{-1}(x) =$

- (A) 2^x
(B) x^2
(C) $\frac{x}{2}$
(D) $\frac{2}{x}$
(E) $\log_x 2$

L2T2_33

34. If $x_0 = 0$ and $x_{n+1} = \sqrt{6 + x_n}$, then $x_3 =$

- (A) 2.449
(B) 2.907
(C) 2.984
(D) 2.997
(E) 3.162

L2T2_34

35. Figure 8 shows a triangle inscribed in a semicircle. What is the area of the triangle in terms of θ ?

(A) $\frac{\theta\pi}{2}$

(B) $\frac{\theta}{2}$

(C) $\tan \theta$

(D) $\sin \theta$

(E) $2 \sin \theta \cos \theta$

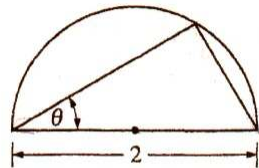


Figure 8

L2T2_35

36. In a certain experiment, there is a 0.2 probability that any thermometer used is in error by more than 1°C . If 4 thermometers are used, what is the probability that all of them are in error by more than 1°C ?

- (A) 0.0016
- (B) 0.0081
- (C) 0.16
- (D) 0.25
- (E) 0.80

L2T2_36

37. If the magnitudes of vectors \mathbf{a} and \mathbf{b} are 5 and 12, respectively, then the magnitude of vector $(\mathbf{b} - \mathbf{a})$ could NOT be

- (A) 5
- (B) 7
- (C) 10
- (D) 12
- (E) 17

L2T2_37

38. If $(6.31)^m = (3.02)^n$, what is the value of $\frac{m}{n}$?

- (A) -0.32
- (B) 0.32
- (C) 0.48
- (D) 0.60
- (E) 1.67

L2T2_38

39. If $\arccos(\cos x) = 0$ and $0 \leq x \leq \frac{\pi}{2}$, then x could equal

- (A) 0
- (B) $\frac{\pi}{6}$
- (C) $\frac{\pi}{4}$
- (D) $\frac{\pi}{3}$
- (E) $\frac{\pi}{2}$

L2T2_39

40. If the 20th term of an arithmetic sequence is 100 and the 40th term of the sequence is 250, what is the first term of the sequence?

- (A) -50
- (B) -42.5
- (C) 5
- (D) 42.5
- (E) 50

L2T2_40

41. If n distinct planes intersect in a line, and another line ℓ intersects one of these planes in a single point, what is the least number of these n planes that ℓ could intersect?

- (A) n
- (B) $n - 1$
- (C) $n - 2$
- (D) $\frac{n}{2}$
- (E) $\frac{n - 1}{2}$

L2T2_41

42. For all θ , $\sin \theta + \sin(-\theta) + \cos \theta + \cos(-\theta) =$

- (A) 0
- (B) 2
- (C) $2 \sin \theta$
- (D) $2 \cos \theta$
- (E) $2(\sin \theta + \cos \theta)$

L2T2_42

43. $\frac{[(n-1)!]^2}{[n!]^2} =$

- (A) $\frac{1}{n}$
- (B) $\frac{1}{n^2}$
- (C) $\frac{n-1}{n}$
- (D) $\left(\frac{n-1}{n}\right)^2$
- (E) $(n-1)^2$

L2T2_43

44. The radius of the base of a right circular cone is 6 and the radius of a parallel cross section is 4. If the distance between the base and the cross section is 8, what is the height of the cone?

- (A) 11
- (B) $13\frac{1}{3}$
- (C) 16
- (D) 20
- (E) 24

L2T2_44

45. An indirect proof of the statement "If $x = 2$, then \sqrt{x} is not a rational number" could begin with the assumption that

- (A) $x = \sqrt{2}$
- (B) $x^2 = 2$
- (C) \sqrt{x} is rational
- (D) \sqrt{x} is not rational
- (E) x is nonnegative

L2T2_45

46. Suppose the graph of $f(x) = -x^2$ is translated 3 units left and 1 unit up. If the resulting graph represents $g(x)$, what is the value of $g(-1.6)$?

- (A) 2.96
- (B) -0.96
- (C) -1.56
- (D) -1.96
- (E) -2.56

L2T2_46

47. In how many ways can 10 people be divided into two groups, one with 7 people and the other with 3 people?

- (A) 120
- (B) 210
- (C) 240
- (D) 5,040
- (E) 14,400

L2T2_47

48. Which of the following has an element that is less than any other element in that set?

- I. The set of positive rational numbers
- II. The set of positive rational numbers r such that $r^2 \geq 2$
- III. The set of positive rational numbers r such that $r^2 > 4$

- (A) None
- (B) I only
- (C) II only
- (D) III only
- (E) I and III

L2T2_48

49. What is the length of the major axis of the ellipse whose equation is $60x^2 + 30y^2 = 150$?

- (A) 1.26
- (B) 2.50
- (C) 3.16
- (D) 4.47
- (E) 5.00

L2T2_49

50. Under which of the following conditions is $\frac{a-b}{ab}$ positive?

- (A) $0 < a < b$
- (B) $a < b < 0$
- (C) $b < a < 0$
- (D) $b < 0 < a$
- (E) None of the above

L2T2_50

Test	Section	Item No.	Difficulty	Correct Answer
Level 2	Test 2	1	79	b
Level 2	Test 2	2	81	d
Level 2	Test 2	3	89	d
Level 2	Test 2	4	52	a
Level 2	Test 2	5	94	c
Level 2	Test 2	6	84	a
Level 2	Test 2	7	89	c
Level 2	Test 2	8	80	c
Level 2	Test 2	9	82	e
Level 2	Test 2	10	84	a
Level 2	Test 2	11	74	e
Level 2	Test 2	12	84	b
Level 2	Test 2	13	85	c
Level 2	Test 2	14	89	a
Level 2	Test 2	15	71	c
Level 2	Test 2	16	96	b
Level 2	Test 2	17	80	b
Level 2	Test 2	18	85	c
Level 2	Test 2	19	65	e
Level 2	Test 2	20	59	b
Level 2	Test 2	21	64	d
Level 2	Test 2	22	79	d
Level 2	Test 2	23	67	c
Level 2	Test 2	24	61	e
Level 2	Test 2	25	68	e
Level 2	Test 2	26	66	d
Level 2	Test 2	27	57	c
Level 2	Test 2	28	56	d
Level 2	Test 2	29	54	c
Level 2	Test 2	30	84	d
Level 2	Test 2	31	48	e
Level 2	Test 2	32	52	c
Level 2	Test 2	33	52	a
Level 2	Test 2	34	42	c
Level 2	Test 2	35	34	e
Level 2	Test 2	36	60	a
Level 2	Test 2	37	24	a
Level 2	Test 2	38	45	d
Level 2	Test 2	39	56	a
Level 2	Test 2	40	28	b
Level 2	Test 2	41	22	b
Level 2	Test 2	42	56	d
Level 2	Test 2	43	51	b
Level 2	Test 2	44	32	e
Level 2	Test 2	45	28	c
Level 2	Test 2	46	33	b
Level 2	Test 2	47	26	a
Level 2	Test 2	48	14	a
Level 2	Test 2	49	24	d
Level 2	Test 2	50	45	c