

Test 7

**Dr. John Chung's
SAT II Mathematics Level 2**

MATHEMATICS LEVEL 2 TEST**REFERENCE INFORMATION**

THE FOLLOWING INFORMATION IS FOR YOUR REFERENCE IN ANSWERING SOME OF THE QUESTIONS IN THIS TEST

Volume of a right circular cone with radius r and height h : $V = \frac{1}{3}\pi r^2 h$

Lateral Area of a right circular cone with circumference of the base c and slant height ℓ : $S = \frac{1}{2}c\ell$

Volume of a sphere with radius r : $V = \frac{4}{3}\pi r^3$

Surface Area of a sphere with radius r : $S = 4\pi r^2$

Volume of a pyramid with base area B and height h : $V = \frac{1}{3}Bh$

Dr. John Chung's SAT II Math Level 2

Answer Sheet

- | | |
|----|----|
| 01 | 26 |
| 02 | 27 |
| 03 | 28 |
| 04 | 29 |
| 05 | 30 |
| 06 | 31 |
| 07 | 32 |
| 08 | 33 |
| 09 | 34 |
| 10 | 35 |
| 11 | 36 |
| 12 | 37 |
| 13 | 38 |
| 14 | 39 |
| 15 | 40 |
| 16 | 41 |
| 17 | 42 |
| 18 | 43 |
| 19 | 44 |
| 20 | 45 |
| 21 | 46 |
| 22 | 47 |
| 23 | 48 |
| 24 | 49 |
| 25 | 50 |

The number of right answers:

The number of wrong answers:

$$\frac{\text{# of correct}}{\text{# of correct}} - \frac{1}{4} \times \frac{\text{# of wrong}}{\text{# of wrong}} = \text{Raw score}$$

Score Conversion Table

Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score
50	800	28	640	6	480
49	800	27	630	5	470
48	800	26	620	4	470
47	800	25	620	3	460
46	800	24	610	2	460
45	800	23	610	1	450
44	800	22	600	0	450
43	800	21	600		
42	800	20	590		
41	800	19	590		
40	780	18	580		
39	760	17	570		
38	750	16	560		
37	740	15	550		
36	720	14	540		
35	710	13	530		
34	700	12	520		
33	690	11	510		
32	680	10	500		
31	670	9	490		
30	660	8	490		
29	650	7	480		

MATHEMATICS LEVEL 2 TEST

For each of the following problems, decide which is the BEST of the choices given. If the exact numerical value is not one of the choices, select the choice that best approximates this value. Then fill in the corresponding circle on the answer sheet

Note: (1) A scientific or graphing calculator will be necessary for answering some (but not all) of the questions in this test. For each question you will have to decide whether or not you should use a calculator.

(2) For some questions in this test you may have to decide whether your calculator should be in the radian mode or the degree mode.

(3) Figures that accompany problems in this test are intended to provide information useful in solving the problems. They are drawn as accurately as possible EXCEPT when it is stated in a specific problem that its figure is not drawn to scale. All figures lie in a plane unless otherwise indicated.

(4) Unless otherwise specified, the domain of any function f is assumed to be the set of all real numbers x for which $f(x)$ is a real number. The range of f is assumed to be the set of all real numbers $f(x)$, where x is in the domain of f .

(5) Reference information that may be useful in answering the questions in this test can be found on the page preceding Question 1.

USE THIS SPACE FOR SCRATCHWORK

1. If $x = 10$, then $\frac{x^{x+1} - x^x}{x^x} =$

- (A) 5 (B) 9 (C) 10 (D) 100 (E) 1000

2. If x and y are positive integers and $x^2 - y^2 = 21$, then which of the following could be the value of x ?

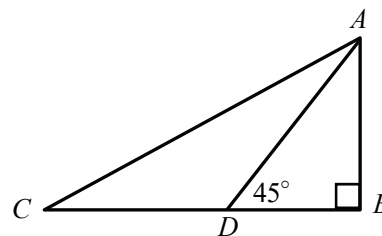
- (A) 13
(B) 11
(C) 10
(D) 9
(E) 4



MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

3. If $f(x) = 4x - 2$, then the inverse function $f^{-1}(x)$ is
- (A) $\frac{x+8}{4}$
 (B) $\frac{2x+1}{2}$
 (C) $\frac{x+2}{4}$
 (D) $\frac{2x-1}{2}$
 (E) $\frac{x-2}{4}$
4. In how many points do the graphs of $x^2 - y^2 = 1$ and $y^2 - x^2 = 1$ intersect?
- (A) 0
 (B) 1
 (C) 2
 (D) 4
 (E) 8
5. If $f(x) = |3x|$ and $g(x) = [2x]$, then $f(g(-5.4)) =$
- (A) 33
 (B) 30
 (C) 25
 (D) 20
 (E) 3
6. In Figure 1, $AD = CD$ and $AB = 5$. Which of the following is the value of $\tan \angle ACD$?
- (A) 0.201
 (B) 0.309
 (C) 0.407
 (D) 0.414
 (E) 0.500



Note: Figure not drawn to scale.

Figure 1

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

7. If $\sin \theta \cos \theta = \frac{1}{4}$, then which of the following is the value(s) of $\sin \theta - \cos \theta$?

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

8. If x increases from $-\frac{\pi}{2}$ to $\frac{\pi}{2}$, then the value of $\sec x$

- (A) decreases, then increases.
(B) increases, then decreases.
(C) increases.
(D) decreases.
(E) none of these

9. If $f\left(\frac{3x}{x-1}\right) = x^2 + 1$, what is the value of $f(6)$?

- (A) 3
(B) 5
(C) 18
(D) 37
(E) 42

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

10. If $f(x) = \frac{x+1}{x-1}$ and $f(g(x)) = \frac{1}{x}$, then which of the following could be $g(x)$?

(A) $x-1$

(B) $\frac{1}{x+1}$

(C) $x+1$

(D) $\frac{1}{x-1}$

(E) $\frac{x+1}{1-x}$

11. What is the range of the function defined by

$$f(x) = \begin{cases} x^2, & x \geq 0 \\ \frac{1}{x}, & x < 0 \end{cases}$$

(A) $y > 0$

(B) $y < 0$

(C) $y \neq 0$

(D) $y \geq 0$

(E) All real numbers

12. If $2\log x = \log(2x+3)$, then which of the following is the solution set of x ?

(A) $\{-1\}$

(B) $\{-1, 3\}$

(C) $\{3\}$

(D) $\{3, 4\}$

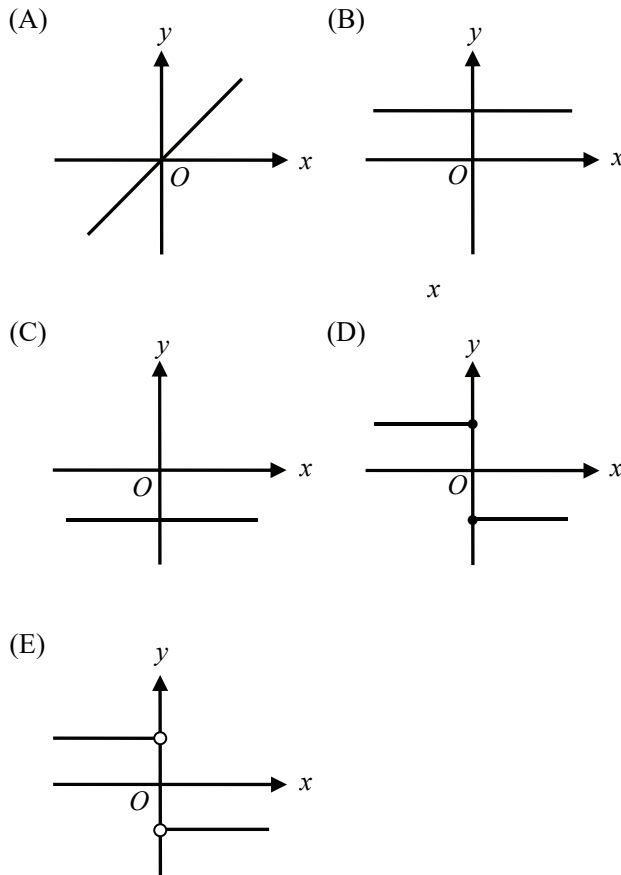
(E) All real numbers

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

13. Which of the following could be the graph of $y = -\frac{|x|}{x}$?



14. Which of the following is the equation of the polynomial with roots $1 - \sqrt{2}$ and i ?

- (A) $x^3 + x + 1$
 (B) $x^3 - 2$
 (C) $x^4 - 2$
 (D) $x^4 - 3x^2 + 2$
 (E) $x^4 - 2x^3 - 2x - 1$

15. If $a = \log_5 9$, then 25^{2a} is

- (A) 81 (B) 729 (C) 2187 (D) 6561 (E) 13122

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

16. If the volume of a cube is 6^{3a} , then the surface area of the cube is

(A) 6^{2a}
(B) $6(6^a)$
(C) $6(3^{2a})$
(D) 6^{2a+1}
(E) 6^{2a+3}

17. If $\cos 2x = \frac{1}{2}$, then $\sin x =$

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

18. If $\text{Arc sin}\left(-\frac{\sqrt{3}}{2}\right) = k$, then $\tan k =$

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

19. Which of the following is the domain of $f(x) = \frac{\sqrt{x-1}}{x-2}$?

(A) All real numbers
(B) All real numbers except 2
(C) All real numbers greater than or equal to 1
(D) All real numbers greater than or equal to 2
(E) All real numbers greater than or equal to 1 except 2



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MATHEMATICS LEVEL 2 TEST - *Continued*

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20. If ${}_x C_{x-2} = 21$, then $x =$

- (A) 4
- (B) 5
- (C) 6
- (D) 7
- (E) 8

21. On a multiple-choice test, there are 5 choices for each question. What is the probability that a student who guesses every answer will have exactly 10 correct answers on a test that consists of 20 questions?

- (A) 0.002
- (B) 0.02
- (C) 0.2
- (D) 0.25
- (E) 0.5

22. What is the sum of the numerical coefficients of $(x - 2y)^4$?

- (A) 0
- (B) 1
- (C) 16
- (D) 32
- (E) 48

23. What is the value of $\sum_{n=1}^{100} i^n$?

- (A) 0
- (B) 1
- (C) i
- (D) $-i$
- (E) -1



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MATHEMATICS LEVEL 2 TEST - *Continued*

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24. If $3 - i\sqrt{2}$ is the root of the quadratic equation $ax^2 - 12x + c = 0$, what is the value of c ?

(A) 11
 (B) 22
 (C) 25
 (D) 33
 (E) 44

25. In Figure 2, which of the following is the equation of the graph?

(A) $y = 3 \sin 2\theta$
 (B) $y = 3 \sin 4\theta$
 (C) $y = 3 \sin 8\theta$
 (D) $y = 3 \sin \frac{\pi\theta}{2}$
 (E) $y = 3 \sin \frac{\pi\theta}{4}$

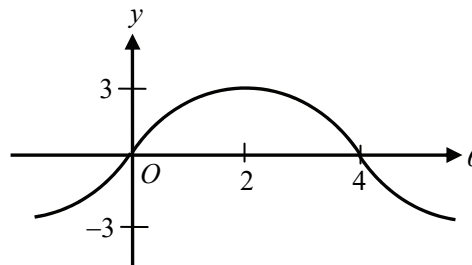


Figure 2

26. What is the length of the major axis of an ellipse whose equation is $x^2 + 4y^2 + 4x - 8y = 8$?

(A) 4 (B) 8 (C) 12 (D) 16 (E) 20

27. What is the slope of the line tangent to the circle $(x-1)^2 + (y-1)^2 = 25$ at the point $(4,5)$?

(A) $-\frac{4}{3}$
 (B) $-\frac{3}{4}$
 (C) $-\frac{5}{4}$
 (D) $-\frac{4}{5}$
 (E) $\frac{4}{5}$

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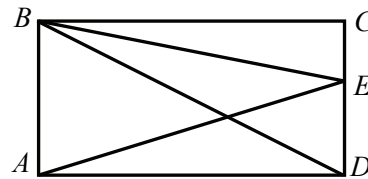
USE THIS SPACE FOR SCRATCHWORK.

28. If $f(x) = f\left(x + \frac{\pi}{2}\right)$, then which of the following could be $f(x)$?

- (A) $f(x) = \sin x$
 (B) $f(x) = 2 \sin 2x$
 (C) $f(x) = \cos x$
 (D) $f(x) = 2 \cos 2x$
 (E) $f(x) = 2 \tan 2x$

29. In Figure 3, $ABCD$ is a rectangle and $\tan \angle CBE = \frac{1}{7}$ and $\tan \angle EAD = \frac{1}{3}$. What is the value of $\tan \angle BDA$?

- (A) 0.488
 (B) 0.476
 (C) 0.434
 (D) 0.421
 (E) 0.306



Note: Figure not drawn to scale.

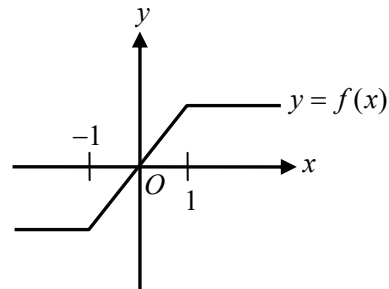
Figure 3

30. If $f(x) = \frac{1}{x-3} + 2$, what is the range of the function?

- (A) $y \geq 2$
 (B) $y \leq 2$
 (C) $y \neq 3$
 (D) $y \neq 2$
 (E) All real

31. Figure 4 shows the graph of $f(x)$. Which of the following could be the function $f(x)$?

- (A) $y = |x| + |x-1|$
 (B) $y = |x+1| + |x-1|$
 (C) $y = |x-1| - |x+1|$
 (D) $y = |x+1| - |x-1|$
 (E) $y = |x+1| - |x|$



Note: Figure not drawn to scale.

Figure 4

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MATHEMATICS LEVEL 2 TEST - *Continued*

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32. The right circular cone is sliced horizontally forming two pieces, each of which has the same height. What is the ratio of the volume of the smaller piece to the volume of the larger piece?

- (A) $\frac{1}{2}$
(B) $\frac{1}{4}$
(C) $\frac{1}{5}$
(D) $\frac{1}{7}$
(E) $\frac{1}{8}$

33. How many possible rational zeros does

$$f(x) = 2x^3 + 3x^2 - 8x + 4$$
 have?

- (A) 6
(B) 8
(C) 10
(D) 12
(E) 14

34. What is the polar form of the rectangular equation

$$x^2 + y^2 - 4x = 0?$$

- (A) $r = \sin \theta$
(B) $r^2 = 4 \sin \theta$
(C) $r = 4 \cos \theta$
(D) $r = 4 \sin \theta$
(E) $r = 2 \cos \theta$

35. $\lim_{x \rightarrow 1} \frac{x-1}{x^3 - x^2 + x - 1} =$

- (A) $\frac{1}{4}$ (B) $\frac{1}{2}$ (C) $\frac{2}{3}$ (D) 2 (E) 5

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