

# Test 6

**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  $\ell$ :  $S = \frac{1}{2}c\ell$

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  $\frac{1}{x} - x = \frac{1}{x} + x$ , then  $x =$

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

2. If  $\frac{1}{1 - \frac{1}{x}} = 2$ , what is the value of  $x$ ?

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

3. If  $3^x = 5^y$ , then  $\frac{x}{y} =$

- (A)  $\frac{3}{5}$  (B)  $\frac{5}{3}$  (C)  $\log_3 5$  (D)  $\log_5 3$  (E)  $3^5$

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**MATHEMATICS LEVEL 2 TEST - *Continued***

**USE THIS SPACE FOR SCRATCHWORK.**

4. What is the number of arrangements of letters that can be formed from the letters of the word “abscissa”?
- (A) 40320  
(B) 20160  
(C) 6720  
(D) 3360  
(E) 1680
5. If  $(\log x)^2 + \log x^2 = 3$ , then which of the following could be the value of  $x$ ?
- (A) -10 (B) 3 (C) 5 (D) 8 (E) 10
6. What is the minimum value of  $y = \sin|x| + 3$ ?
- (A) 0 (B) 1 (C) 2 (D) 3 (E) 4
7. If  $\frac{1}{x^2 - 1} = \frac{A}{x + 1} + \frac{B}{x - 1}$  for all real  $x$ , what is the value of constant  $B$ ?
- (A) -1 (B)  $-\frac{1}{2}$  (C)  $\frac{1}{2}$  (D) 1 (E) 2
8. If  $x + \sqrt{(1 - \sqrt{3})^2} = 3$ , then  $x =$
- (A)  $1 - \sqrt{3}$   
(B)  $4 - \sqrt{3}$   
(C)  $2 + \sqrt{3}$   
(D)  $\sqrt{3} - 2$   
(E)  $\sqrt{3} - 4$
9. In Figure 1, if  $\triangle ABC$  is equilateral, what is the slope of  $\overline{BC}$ ?
- (A)  $-\sqrt{3}$  (B)  $-\sqrt{2}$  (C) -1 (D) 1 (E)  $\sqrt{3}$

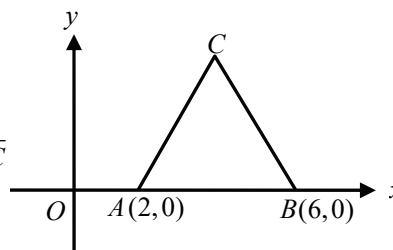


Figure 1

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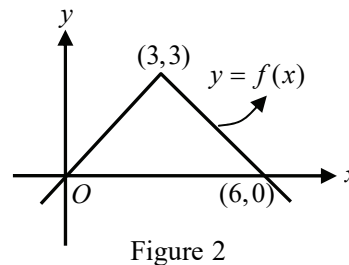
**MATHEMATICS LEVEL 2 TEST - *Continued***

**USE THIS SPACE FOR SCRATCHWORK.**

10. If  $\tan \theta = \frac{1}{2}$ , then  $(\sin \theta + \cos \theta)^2 =$
- (A) 1.8   (B) 2.0   (C) 2.2   (D) 2.4   (E) 2.6

11. The graph of  $y = f(x)$  is shown in Figure 2. Which of the following is the equation of the graph?

- (A)  $y = |x| + 3$   
 (B)  $y = |x + 3| + 3$   
 (C)  $y = -|x + 3| + 3$   
 (D)  $y = -|x - 3| + 3$   
 (E)  $y = -|x - 3| - 3$



12. If  $f(x) = \log_2(x^2 + 7)$  and  $f(g(1)) = 4$ , which of the following could be  $g(x)$ ?
- (A)  $g(x) = x^2 + x + 2$   
 (B)  $g(x) = 2x^2 + x - 1$   
 (C)  $g(x) = \cos(\pi x) + 4$   
 (D)  $g(x) = \sin(\pi x) + 2$   
 (E)  $g(x) = 3^x - 1$
13. If the roots of  $2x^2 - kx + 14 = 0$  are integers, then which of the following could be the value of constant  $k$ ?
- (A) 6   (B) 8   (C) 10   (D) 12   (E) 16
14. Which of the following is an equation with roots 0 and  $2 - \sqrt{3}$ ?
- (A)  $0 = x^3 - 3x^2 + x$   
 (B)  $0 = x^3 + 4x^2 - x$   
 (C)  $0 = x^3 - 4x^2 + x$   
 (D)  $0 = x^2 - 2x - 2$   
 (E)  $0 = x^3 + 2x^2 + 2x$

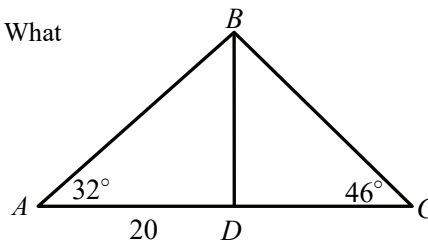
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**MATHEMATICS LEVEL 2 TEST - Continued**

**USE THIS SPACE FOR SCRATCHWORK.**

15. How far is the point  $(2,1)$  from the line  $3x - y = 4$ ?
- (A) 0.316  
 (B) 0.542  
 (C) 1.358  
 (D) 2.855  
 (E) 3.282
16. If the polar coordinates of point  $A$  are  $\left(10, \frac{2\pi}{3}\right)$ , which of the following are the rectangular coordinates of point  $A$ ?
- (A)  $(-5\sqrt{3}, 5)$   
 (B)  $(5, 5\sqrt{3})$   
 (C)  $(5, -5\sqrt{3})$   
 (D)  $(-5, 5\sqrt{3})$   
 (E)  $(-5, -5\sqrt{3})$

17. In Figure 3,  $AD = 20$  and  $\overline{BD}$  is perpendicular to  $\overline{AC}$ . What is the length of  $\overline{CD}$ ?
- (A) 10.35  
 (B) 12.07  
 (C) 13.06  
 (D) 14.85  
 (E) 15.50



Note: Figure not drawn to scale.

Figure 3

18. If  $(\sqrt{3})^{4-6x} = 27^x$ , then  $x =$
- (A)  $\frac{1}{3}$    (B)  $\frac{1}{2}$    (C)  $\frac{2}{3}$    (D)  $\frac{3}{4}$    (E)  $\frac{3}{2}$

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

19. Which of the following is the solution of  $\frac{x}{(x-1)(x-2)} < 0$ ?

- (A)  $-\infty < x < 1$
- (B)  $-5 < x < 2$
- (C)  $-\infty < x < 2$
- (D)  $-\infty < x < 0$  or  $1 < x < 2$
- (E)  $-\infty < x < 1$  or  $x > 2$

20. What are the asymptotes of  $f(x) = \frac{x}{x^3 + x}$ ?

- (A)  $x = 0$
- (B)  $x = 0$  and  $x = -1$
- (C)  $x = -1$  and  $y = 0$
- (D)  $y = 0$
- (E)  $x = 0$  and  $y = 0$

21. If  $f(x) = \log_3(\sqrt{x}) + 3$  and  $g(x)$  is the inverse of  $f(x)$ , what is the value of  $g(2)$ ?

- (A)  $\frac{1}{27}$  (B)  $\frac{1}{9}$  (C)  $\frac{1}{3}$  (D) 3 (E) 9

22. If  $\sin 2\theta = \frac{1}{4}$ , what is the value of  $(\cos \theta - \sin \theta)^2$ ?

- (A) 1.25
- (B) 0.75
- (C) 0.50
- (D) 0.25
- (E) 0.15



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**MATHEMATICS LEVEL 2 TEST - Continued**

**USE THIS SPACE FOR SCRATCHWORK.**

23. Which of the following is a horizontal tangent to the ellipse

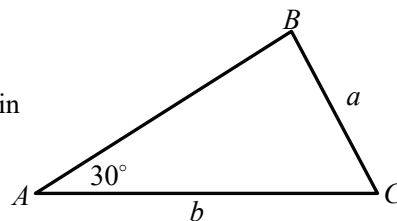
$$\frac{(x-3)^2}{49} + \frac{(y-2)^2}{25} = 1?$$

- (A)  $y = 2$   
 (B)  $y = 3$   
 (C)  $y = 5$   
 (D)  $y = 7$   
 (E)  $y = 10$
24. Which of the following is true of the graph of the function  
 $xy = x^2 + 1$ ?
- (A) Even function  
 (B) Odd function  
 (C) Symmetric with respect to  $x$ -axis  
 (D) Symmetric with respect to  $y$ -axis  
 (E) Symmetric with respect to  $y = x$

25. What is the value of  $\left| \frac{2+i}{i-2} \right|$ ?

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

26. In  $\triangle ABC$ , if  $\angle A = 30^\circ$ ,  $a = 5$  and  $b = 10$ , then  $\triangle ABC$  in Figure 5 is



Note: Figure not drawn to scale.

Figure 5

27. If  $\cos^2 \theta + \cos \theta = 1$ , then  $\sin^4 \theta + \sin^2 \theta =$

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

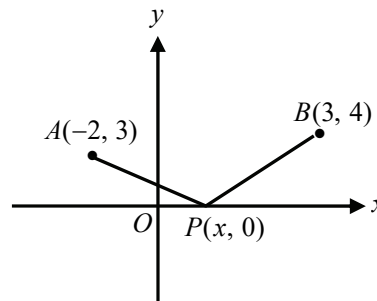
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**MATHEMATICS LEVEL 2 TEST - *Continued***

**USE THIS SPACE FOR SCRATCHWORK.**

28. What is the period of the function  $y = -2 \tan\left(\frac{x}{3} - 1\right) + 4$ ?
- (A)  $\frac{1}{3}$    (B)  $2\pi$    (C)  $3\pi$    (D)  $6\pi$    (E)  $8\pi$

29. In Figure 6, point  $P$  is on the  $x$ -axis. What is the minimum length of  $\overline{AP} + \overline{PB}$ ?
- (A) 7.48  
(B) 8.60  
(C) 9.25  
(D) 9.75  
(E) 13.75



Note: Figure not drawn to scale.

Figure 6

30. The roots of  $x^2 + kx + 1 = 0$  are  $p$  and  $q$ , where  $k$  is a constant. If  $\frac{1}{p} + \frac{1}{q} = 10$ , what is the value of  $k$ ?
- (A) -10  
(B) -5  
(C) 5  
(D) 10  
(E) 15
31. If  $(x-1)$  is a factor of  $x^6 - 5x^4 + 4x^3 - x + k$ , then what is the value of  $k$ ?
- (A) 1   (B) 2   (C) 3   (D) 4   (E) 5
32. If the quadratic equation  $x^2 + 2ax + 2a^2 + 2a - 3 = 0$  has real roots, then which of the following could NOT be the value of  $a$ ?
- (A) -2  
(B) -1  
(C) 0  
(D) 1  
(E) 2

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

33. What is the distance from the plane  $x - 2y + 3z = 5$  to the point  $(2, 2, 0)$ ?
- (A) 1.871  
(B) 2.225  
(C) 2.786  
(D) 3.125  
(E) 4.750
34. If the line through  $(5, 4)$  and  $(2, k)$  is perpendicular to the line with equation  $3x - 4y = 4$ , what is the value of  $k$ ?
- (A) 2  
(B) 4  
(C) 6  
(D) 8  
(E) 10
35. If the radius of a right circular cone is 6 and the height of the cone is 8, what is the lateral surface area of the cone?
- (A)  $20\pi$   
(B)  $40\pi$   
(C)  $60\pi$   
(D)  $96\pi$   
(E)  $120\pi$
36. If  $y = 3 \log(10x - x^2)$ , what is the maximum value of  $y$ ?
- (A) 3.56  
(B) 4.19  
(C) 5.25  
(D) 6.32  
(E) 7.41
37. What is the length of the major axis of the ellipse whose equation is  $5x^2 + 18y^2 - 90 = 0$ ?
- (A) 6.25 (B) 7.25 (C) 8.49 (D) 9.34 (E) 10.25

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

38. In Figure 7,  $A$ ,  $B$ , and  $C$ , the vertices of the squares, are collinear. What is the value of  $k$ ?

- (A) 8.45  
 (B) 10.38  
 (C) 12.25  
 (D) 13.12  
 (E) 13.74

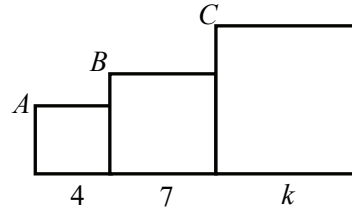


Figure 7

39. If  $\theta = \text{Arccos}\left(-\frac{\sqrt{3}}{2}\right)$ , then  $\theta =$

- (A)  $-\frac{5\pi}{6}$  (B)  $-\frac{\pi}{6}$  (C)  $\frac{\pi}{6}$  (D)  $\frac{\pi}{2}$  (E)  $\frac{5\pi}{6}$

40. In a box there are 4 red marbles and 5 white marbles. If marbles are drawn one at a time and replaced after each drawing, what is the probability of drawing exactly 2 red marbles when 3 marbles are drawn?

- (A) 0.329  
 (B) 0.235  
 (C) 0.198  
 (D) 0.110  
 (E) 0.102

41. In Figure 8,  $P$  is a point in the square of side-length 10 such that it is equally distant from two consecutive vertices and from the opposite side  $\overline{AD}$ . What is the length of  $\overline{BP}$ ?

- (A) 5  
 (B) 5.25  
 (C) 5.78  
 (D) 6.25  
 (E) 7.07

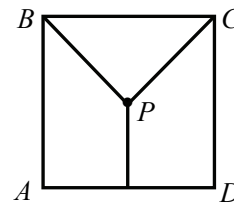


Figure 8

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