

Test 4

**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. $\left(a - \frac{1}{a}\right)^2 - \left(a + \frac{1}{a}\right)^2 =$

- (A) 4
- (B) -4
- (C) 2
- (D) -2
- (E) $2a$

2. If $\cos x = \frac{1}{3}$ for $0 < x < \frac{\pi}{2}$, then $\sin 2x =$

- (A) 0.25
- (B) 0.30
- (C) 0.50
- (D) 0.63
- (E) 0.75

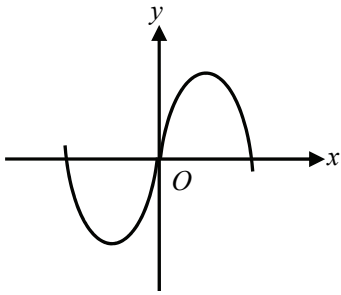
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MATHEMATICS LEVEL 2 TEST - *Continued*

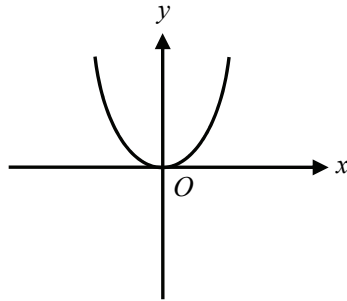
USE THIS SPACE FOR SCRATCHWORK.

3. The inverse of which of the following graphs is also a function?

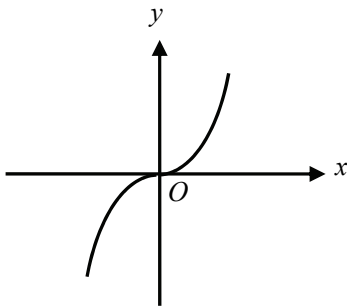
(A)



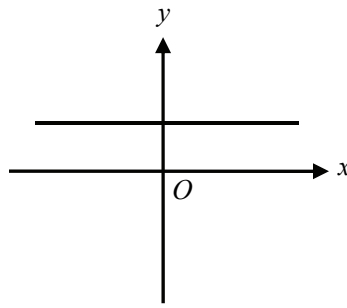
(B)



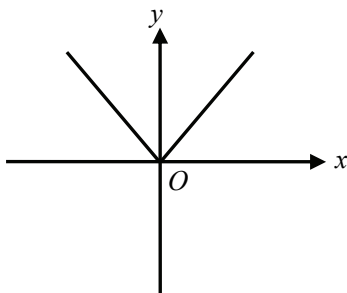
(C)



(D)



(E)

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

4. If $\sqrt{x^2} = 5$, then $x =$
- (A) 5 only
(B) -5 only
(C) 5 and -5
(D) 25 and -15
(E) -25 only
5. The radius of the circle $x^2 - 2x + y^2 - 4y = 9$ is
- (A) 3.00
(B) 3.74
(C) 4.12
(D) 5.43
(E) 6.15
6. If $f(x) = \sqrt{9x^2 - x}$ and $g(x) = \frac{x-1}{x+1}$, then $f(g(2)) =$
- (A) $\frac{\sqrt{2}}{3}$ (B) $\frac{\sqrt{3}}{3}$ (C) $\frac{\sqrt{5}}{3}$ (D) $\frac{\sqrt{6}}{3}$ (E) $\frac{2\sqrt{2}}{3}$
7. If $f(x) = 5$ for all real numbers x , then $f(x-2) + f(x+2) =$
- (A) 0 (B) 2 (C) 5 (D) 10 (E) 20
8. $\frac{(10! \times 10!)}{(9!)^2} =$
- (A) $\frac{100!}{81!}$
(B) $\frac{100}{81}$
(C) 100
(D) $\frac{1000}{81}$
(E) $\frac{10000}{9}$

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

9. The set of all real numbers of x such that $|x^2 - 1| < 1$ consists of
- (A) $\{x < -\sqrt{2}\}$
(B) $\{-\sqrt{2} < x < 0\} \cup \{0 < x < \sqrt{2}\}$
(C) $\{0 < x < \sqrt{2}\}$
(D) $\{x < -\sqrt{2}\} \cup \{x > \sqrt{2}\}$
(E) $\{x > \sqrt{2}\}$
10. If the line $y = x + k$ is tangent to the graph of the circle $x^2 + y^2 = 4$, then $k =$
- (A) $2\sqrt{2}$ only
(B) $3\sqrt{2}$ only
(C) $4\sqrt{2}$ only
(D) $\pm 2\sqrt{2}$
(E) $\pm 4\sqrt{2}$
11. If $f(x) = 2\ln(x+1)$ and $g(x) = e^x$, then $(g \circ f)(x) =$
- (A) e^{x+1}
(B) e^{x^2+2x+1}
(C) $x+1$
(D) $2(x+1)$
(E) $x^2 + 2x + 1$
12. If $f(x) = x^3 + 3x + 1$, then $f^{-1}(f(x)) =$
- (A) x
(B) x^2
(C) $x^3 + 3x + 1$
(D) $\sqrt[3]{x^3 + 3x + 1}$
(E) $(x^3 + 3x + 1)^3$

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MATHEMATICS LEVEL 2 TEST - *Continued*

USE THIS SPACE FOR SCRATCHWORK.

13. $\log_{16} 81 - \log_2 3 =$
- (A) -2 (B) -1 (C) 0 (D) 1 (E) 3
14. Three numbers have a sum of 36, a product of 1680, and form an arithmetic sequence. What is the largest number?
- (A) 10
(B) 12
(C) 14
(D) 16
(E) 18
15. If $a + bi = \frac{3+i}{1+i}$, which of the following is true?
- (A) $a = 1, b = 2$
(B) $a = 2, b = 1$
(C) $a = 2, b = -1$
(D) $a = -2, b = 1$
(E) $a = -2, b = -1$
16. If $\sin(A + B) = 0.25$, $\sin A = \frac{\sqrt{3}}{2}$, and $90^\circ < A + B < 180^\circ$, then B could be
- (A) 65°
(B) 80.5°
(C) 105.5°
(D) 120.5°
(E) 125.4°

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MATHEMATICS LEVEL 2 TEST - *Continued*

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17. If the equation of a parabola is $y = 2x^2$, then the directrix of the graph is

(A) $y = 2$

(B) $y = \frac{1}{2}$

(C) $y = \frac{1}{8}$

(D) $y = -\frac{1}{8}$

(E) $y = -\frac{1}{2}$

18. Which of the following is symmetric with respect to the origin?

(A) $y = x^2 - x$

(B) $y = x + 5$

(C) $y = x^5 + 3x^3 + x$

(D) $y = x^6 + x^4 + x^2$

(E) $y = x^7 + x^5 + 1$

19. What is the x -intercept of the hyperbola

$$\frac{(x-1)^2}{10} - \frac{(y+2)^2}{4} = 1?$$

(A) (4.16, 0) and (-4.16, 0)

(B) (3.12, 0) and (-3.12, 0)

(C) (4.16, 0) and (-2.16, 0)

(D) (5.47, 0) and (-3.47, 0)

(E) (5.12, 0) and (-5.12, 0)



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MATHEMATICS LEVEL 2 TEST - *Continued*

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20. $\sin\left(\theta - \frac{\pi}{2}\right) =$
- (A) $\sin \theta$
(B) $-\sin \theta$
(C) $\cos \theta$
(D) $-\cos \theta$
(E) $\sin \theta \cos \theta$
21. Which of the following is the solution set of $\frac{(x-2)(x-1)^2}{x+2} \leq 0$
- (A) $x < -2$
(B) $x \geq 0$
(C) $-2 \leq x \leq 1$
(D) $-2 < x \leq 2$
(E) $-2 \leq x \leq 1$ or $x > 2$
22. There are 4 boys and 5 girls in a chess club. In how many ways could 3 boys and 3 girls be selected to attend the school tournament?
- (A) 40
(B) 80
(C) 120
(D) 360
(E) 720
23. If the probability that a light bulb is defective is $\frac{1}{10}$, what is the probability that a package of 10 light bulbs has exactly two defective bulbs?
- (A) 0.01 (B) 0.10 (C) 0.19 (D) 0.25 (E) 0.33

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MATHEMATICS LEVEL 2 TEST - *Continued*

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24. A polynomial $P(x)$ has remainder of three when divided by $(x-1)$ and remainder of five when divided by $(x-2)$. If $P(x)$ is divided by $(x-1)(x-2)$, then the remainder is
- (A) 8
 (B) $x+8$
 (C) $2x-1$
 (D) $2x+1$
 (E) $3x+1$

25. In Figure 1, a triangle is inscribed in a semicircle. If $BC = 10$, what is the area of $\triangle ABC$ in terms of θ ?

- (A) $50 \sin \theta$
 (B) $50 \cos \theta$
 (C) $50 \sin \theta \cos \theta$
 (D) $50 \tan \theta$
 (E) $\frac{50}{\tan \theta}$

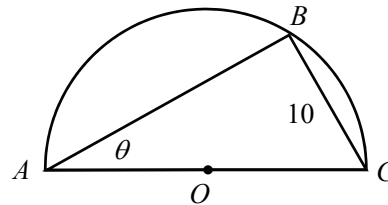


Figure 1

26. If a rectangular prism has dimensions a , b , and c , which of the following represents the length of its diagonal?
- (A) $\sqrt{a+b+c}$
 (B) $\sqrt[3]{a^2+b^2+c^2}$
 (C) $\sqrt{a^2+b^2+c^2}$
 (D) $\sqrt{a^3+b^3+c^3}$
 (E) $\sqrt[3]{a^3+b^3+c^3}$

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MATHEMATICS LEVEL 2 TEST - *Continued*

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27. If vectors $\vec{a} = (3, -4)$ and $\vec{b} = (-2, 3)$, then $|\vec{a} - \vec{b}| =$

- (A) 5.68
- (B) 7.07
- (C) 8.60
- (D) 9.13
- (E) 10.87

28. If $3 + 4i$ is a root of $2x^2 + ax + b = 0$, then $b =$

- (A) 25
- (B) -25
- (C) 50
- (D) -50
- (E) It cannot be determined from the information given.

29. If $\cos \theta = -\frac{1}{3}$ and $90^\circ < \theta < 180^\circ$, then $\sin(2\theta)$ equals

- (A) $\frac{3\sqrt{3}}{8}$
- (B) $-\frac{3\sqrt{2}}{8}$
- (C) $\frac{4\sqrt{2}}{9}$
- (D) $-\frac{4\sqrt{2}}{9}$
- (E) $-\frac{5\sqrt{2}}{11}$

30. What is the distance from the plane $3x - 4y - 5z + 10 = 0$ to the point $(0, 0, 0)$?

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



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MATHEMATICS LEVEL 2 TEST - *Continued*

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31. If $x_0 = 1$ and $x_{n+1} - x_n = 2n$, then $x_{10} =$
- (A) 20
(B) 91
(C) 162
(D) 268
(E) 381
32. The line $ax + by - 4 = 0$ forms a triangular region with the x -axis and y -axis. What is the area of the region in terms of a and b ?
- (A) $\frac{2}{|ab|}$ (B) $\frac{4}{|ab|}$ (C) $\frac{|ab|}{8}$ (D) $\frac{|ab|}{16}$ (E) $\frac{8}{|ab|}$
33. Which of the following is equivalent to the expression $\frac{\tan 70^\circ - \tan 20^\circ}{1 + \tan 70^\circ \tan 20^\circ}$?
- (A) $\tan 90^\circ$
(B) $\tan 50^\circ$
(C) $\frac{\tan 90^\circ}{\tan 50^\circ}$
(D) $\frac{\tan 50^\circ}{1 - \tan 50^\circ}$
(E) $\frac{1 - \tan 50^\circ}{\tan 50^\circ}$
34. In $\triangle ABC$, $\angle B$ is an obtuse angle, $AB = 15$, $BC = 20$, and the area of the triangle is 90. What is the measure of $\angle B$?
- (A) 0.36
(B) 0.64
(C) 2.50
(D) 5.48
(E) 5.63

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