

UPCAT MATHEMATICS REVIEWER

(60 ITEMS)

Send your answer to reviewermath@yahoo.com. We'll give you your score, percentile rank and detailed solution to this reviewer through your e-mail address. Please provide the following information in your email: Name of School, Municipality/City, Gender, Final grade in Math III, Average daily allowance ("baon"). All information you provide will be held in strict confidence. This reviewer is for high school students preparing for the U.P. College Admission Test in August 2010.

1. Amanda wants to buy a graphing calculator that is already on sale for P4200. The sale price is 30% below the original price. If she is able to get an additional 15% off for being a student, how much money was saved from the original price?

- (A) P1,890.00 (B) P1,170.00 (C) P2,000.00 (D) P2,430.00

2. Let r and s be the roots of the quadratic equation

$$(x-2)(x-3) + (x-3)(x+1) + (x+1)(x-2) = 0.$$

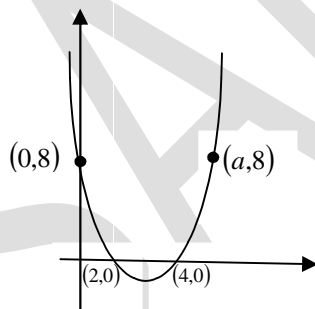
Evaluate: $\frac{1}{(r+1)(s+1)} + \frac{1}{(r-2)(s-2)} + \frac{1}{(r-3)(s-3)}.$

- (A) $\frac{1}{4}$ (B) $\frac{3}{17}$ (C) $\frac{8}{11}$ (D) $\frac{4}{15}$

3. Solve for x : $25(30^x) = (6^3)(5^5)$

- (A) 3 (B) 4 (C) 6 (D) 8

4. The x -intercepts of a parabola are 2 and 4, and the y -intercept is 8. If the parabola passes through the point $(a,8)$, what is the value of a ?



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

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5. Sa isang lungsod, $\frac{2}{5}$ ng mga lalaking may sapat na gulang ay kasal sa $\frac{5}{7}$ ng babaeng may sapat na gulang. Ang bilang ng mga kasal na kalalakihan at kasal na kababaihan ay pantay-pantay, at ang mga may sapat na gulang ng populasyon ay higit sa 3400. Ano ang pinakamaliit na posibleng bilang ng mga may sapat na gulang na residente sa lungsod?

- (A) 3442 (B) 3452 (C) 3432 (D) 3412

6. An **acute angle** is formed by two lines of slope 1 and 7. What is the slope of the line which bisects this angle?

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

7. The altitude to the hypotenuse of a triangle with angles of 30° and 60° is 3 units. What is the area of the triangle in square units?

- (A) $9\sqrt{2}$ (B) $6\sqrt{3}$ (C) $9\sqrt{3}$ (D) $6\sqrt{2}$

8. What was the Biblical approximation to π ?

- (A) 3.14 (B) $\frac{22}{7}$ (C) 3.1416 (D) 3

9. In the freshman class at Uno High School, there are 18 boys and 12 girls. The average height of the boys is 170 cm, and that of the girls is 160 cm. What is the average height of all the students in the class?

- (A) 165 cm (B) 166 cm (C) 167 cm (D) 168 cm

10. Having found that $(x-2)$ is a factor of $P(x)=3x^3+2x^2-x-30$, which of the following is another factor of $P(x)$?

- (A) $x+3$
(B) $x-10.6$
(C) $3x^2+8x+15$
(D) none of the above

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11. Gawing simple: $(\sqrt{2} + \sqrt{6}) \div \sqrt{2 + \sqrt{3}}$.

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

12. Nicole and Chris have the same grade average before the final exam. The final exam counted as 20% of the semester grade. Nicole got 7 percentage points higher than Chris on her semester grade, and the final exam was worth 100 points. What is the number of points in the positive difference between their final exam grades?

- (A) 30 (B) 25 (C) 50 (D) 35

13. Suppose there is a row of lockers numbered 1 through 50 with all the doors closed. A student is going to walk up and down the lockers opening and closing the locker doors. If a door is closed the student will open it, and if it is open, it will be closed. If the student starts with multiple of one, and continues through multiples of 50. How many lockers are open when the student is finished?

- (A) 5 (B) 10 (C) 7 (D) 8

14. Ang isang mag-aalahas ay may 3 spheres ng ginto. Ang sukat ng kanilang radius ay 3mm, 4mm, at 5mm. Kung ang lahat ng tatlong spheres ay tinunaw at bumuo ng panibagong sphere na ginto. Ano ang sukat ng radius ng bagong sphere na ginto?

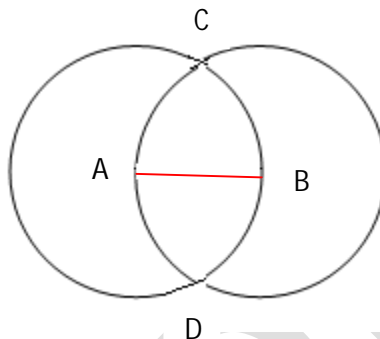
- (A) 8mm (B) 9mm (C) 6 mm (D) 10 mm

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15. Congruent circles of centers A and B intersect such that AB is a radius of each circle. If AB = 4 cm, what is the number of square centimeters in the area ACBD that is common to the two circles?



(A) $\frac{16\pi}{3} - 4\sqrt{3}$

(C) $\frac{16\pi}{3} - 8\sqrt{3}$

(B) $\frac{32\pi}{3} - 4\sqrt{3}$

(D) $\frac{32\pi}{3} - 8\sqrt{3}$

16. The value of $[2 - 3(2 - 3)^{-1}]^{-1}$ is

(A) 5

(C) 1/5

(B) -5

(D) -1/5

17. What is the sum of the first 100 positive odd integers?

(A) 25000

(C) 20000

(B) 50000

(D) 10000

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18. Sa orasan ni Ginoong Abad ay 5:14 a.m. nang siya ay umalis ng bahay. Bumalik siya makalipas ang 7 oras at 11 minuto, subalit nagtaka siya dahil 4:33 pa lang ng umaga sa orasan. Naalala niyang nagkaroon pala ng rotating brown out sa kanilang lugar kaya nang bumalik ang kuryente ay kusang bumalik sa oras na 12:00 a.m. ang orasan. Anong oras ng umaga bumalik ang kuryente?

- (A) 8:52 (C) 5:52
(B) 6:52 (D) 7:52

19. Express in lowest terms: $\frac{n^3 + 7n^2}{n^2 - 2n - 63}$

- (A) $\frac{n}{n-9}$ (B) $\frac{n+7}{n-9}$ (C) $\frac{n^2}{n-9}$ (D) $\frac{n^2}{n+7}$

20. How many square units are in the area defined by the set of points (x,y) in the first quadrant which satisfies $10 \leq x + y \leq 20$?

- (A) 150 (B) 152 (C) 154 (D) 144

21. Fibonacci gave a famous problem about reproducing rabbits. After n months, there is a population of r_n rabbits, where $r_0 = 1$, $r_1 = 2$, $r_2 = 3$ and so on. What was the rabbit population at n=12 months?

- (A) 55 (B) 89 (C) 144 (D) 233

22. For what value of x does $1 + 2 + 3 + 4 + 5 + \dots + x = 171$?

- (A) 17 (B) 16 (C) 18 (D) 21

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23. Three circles of radii 10, 14 and 60 are tangent to each other such that the center of each circle is outside the two other circles. Find the number of square units in the area of the triangle whose vertices are the centers of the three circles?

- (A) 820 (B) 840 (C) 830 (D) 850

24. What is the measure of the obtuse angle formed by two intersecting angle bisectors of an equilateral triangle?

- (A) 150° (B) 110° (C) 120° (D) 100°

25. We select 6 numbers at random, with replacement, from the set of integers from 1 to 300 inclusive. What is the probability that the product of the 6 numbers is even?

- (A) $\frac{31}{32}$ (B) 1 (C) $\frac{61}{64}$ (D) $\frac{63}{64}$

26. A deep well 5 feet in diameter is of unknown depth (to the water level). If a 5-foot post is erected at the edge of the well, the line of sight from the top of the post to the edge of the water surface below will pass through a point 0.4 feet from the lip of the well below the post. What is the depth of the well (to the surface of the water)?

- (A) 37.5 ft (B) 47.5 ft (C) 57.5 ft (D) 67.5 ft

27. Find integers p and q such that $\frac{4+3\sqrt{3}}{2+\sqrt{3}}$ is a root (zero) of the quadratic polynomial $x^2 + px + q$.

- (A) $p = -2$ and $q = 11$ (C) $p = -12$ and $q = 5$
(B) $p = -6$ and $q = 8$ (D) $p = -4$ and $q = 9$

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28. Barb has two watches, one of which loses 6 seconds every 24 hours and the other gains 1 second per hour. He sets both of them to the correct time at 8:00 p.m. How many hours will pass before the positive difference in the time shown is 4 hours?

- (A) 11484 (B) 11520 (C) 11511 (D) 11518

29. Kung ang $3^x = 20$, ano ang halaga ng 9^x ?

- (A) 30 (B) 400 (C) 180 (D) 729

30. Kayang tapusin ng unang pintor ang trabaho sa loob ng 7 oras. Samantalang ang ikalawang pintor ay kayang tapusin ang parehong trabaho sa loob ng 13 oras. Ilang minuto matatapos ang trabaho kung magtutulongan ang dalawang pintor?

- (A) 273 (B) 276 (C) 270 (D) 275

31. Summa Cum Laundry Inc. now has 5000 customers. Its number of customers increases by 20 % each year. At the end of how many full years will its number of customers first exceed 10,000?

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

32. Which of the following is equal to $\sqrt[3]{54} + \sqrt[4]{4}$.

- (A) $\sqrt[3]{128}$ (B) $\sqrt[3]{56}$ (C) $\sqrt[4]{216}$ (D) $\sqrt[4]{112}$

33. On a number line, how many integers are no more than 8 units from 20 and also at least 10 units from 35?

- (A) 18 (B) 12 (C) 15 (D) 14

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34. Ang limang magkakasunod na integer ay may average na x . Ano ang pinakamababang integer?

- (A) $x-2$ (B) $x-3$ (C) $x-4$ (D) $x-5$

35. The lines $y = (k - 5)x + 5$ and $y = -2x + 7$ are perpendicular if $k =$

- (A) $11/2$ (B) 5 (C) $-2/9$ (D) $9/2$

36. Find the length of the radius of the circle $x^2 + 4x + y^2 - 6y - 3 = 0$.

- (A) 2 (B) 3 (C) 4 (D) 9

37. Given that $\begin{cases} x + y + z = 0 \\ x^2 + y^2 + z^2 = 1 \end{cases}$, find the value of $x^4 + y^4 + z^4$.

- (A) $2/5$ (B) $1/3$ (C) 3 (D) $1/2$

38. Simplify: $\frac{\frac{1}{b} + \frac{1}{c}}{b^2 - c^2}$

- (A) $\frac{1}{bc(b-c)}$ (C) $\frac{1}{bc}$
(B) $\frac{bc}{b-c}$ (D) $\frac{b-c}{bc}$

39. Let $f(x) = \begin{cases} x-11 & \text{if } x \leq 6 \\ x+11 & \text{if } x > 6 \end{cases}$. Find $f(12) + f(6)$

- (A) -4 (B) 28 (C) 40 (D) 18

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40. The graph of $16x - 2y = 48$ intersects the y-axis at the point (a,b). What is the sum of a and b?

- (A) -4 (B) -24 (C) 32 (D) 12

41. For what values of the variable x does the following inequality hold?

$$\frac{4x^2}{(1 - \sqrt{1 + 2x})^2} < 2x + 9?$$

- (A) $x \leq -\frac{1}{2}$ or $x > \frac{45}{8}$ (C) $-\frac{1}{2} \leq x < \frac{45}{8}$ except $x = 0$
(B) $x \geq -\frac{1}{2}$ except $x = 0$ (D) $x < \frac{45}{8}$ except $x = 0$

42. All the sides of a given triangle are whole numbers. The perimeter of the triangle is 110 inches and one side has measure 29 inches. What is the fewest number of inches that can be the length of one of the remaining sides?

- (A) 30 (C) 26
(B) 24 (D) 27

43. If a regular polygon has 27 diagonals, how many sides does it have?

- (A) 12 (C) 9
(B) 6 (D) 7

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44. If a and b are each chosen from the set $\{1, 2, 3, 5, 10\}$, what is the largest possible value of

$$\frac{a}{b} + \frac{b}{a} ?$$

- (A) 20
(B) $12\frac{1}{2}$
(C) $10\frac{1}{10}$
(D) $2\frac{1}{2}$

45. Which of the following relations are functions?

I. $x^2 + y^2 = 4$

IV. $x = y^2 - 1$

II. $x - y = 2x$

V. $y = x^2 - 1$

III. $y = \sqrt{4 - x}$

VI. $x^2 = y^2$

- (A) I, II, III
(B) II, III, IV
(C) II, III, V
(D) I, IV, VI

46. Suppose $x + y = 3$, $x^2 + y^2 = 13$. Find the value of xy .

- (A) 39 (B) -6 (C) 24 (D) -2

47. Suppose there are 12 points on a circle, equally spaced. Of all triangles having all their vertices at three of these 12 points, how many are of the type $30^\circ - 60^\circ - 90^\circ$?

- (A) 24 (B) 36 (C) 72 (D) none of these

48. Find all the values of x satisfying the given conditions: $y_1 = \frac{x-3}{3}$, $y_2 = \frac{x-3}{4}$, and

$$y_1 - y_2 = 3$$

- (A) 39 (B) 49 (C) 59 (D) 69

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49. The lines $y = 2x$ and $2y = -x$ are

- (A) parallel (B) perpendicular (C) horizontal (D) vertical

50. Suppose the following two quadratic equations

$$x^2 - 5x + k = 0 \text{ and } x^2 - 9x + 3k = 0$$

have a non-zero root in common. What is the value of k ?

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

51. Let x , y , and z represent lengths of the sides of a right triangle with $y < z < x$. If

$L = 6x^2 + 15y^2 + 15z^2$, find the value of $\frac{L}{y^2 + z^2}$.

- (A) 12 (B) 15 (C) 18 (D) 21

52. The arithmetic mean of 14 numbers is what percent of the sum of the same 14 numbers?. Express your answer as a decimal to the nearest hundredth.

- (A) 7.69% (B) 7.14% (C) 8.33% (D) 5.88%

53. Let $f(x) = \frac{x}{\ln x}$ and $\pi(x)$ denotes the number of primes less than or equal to x . When Gauss was 15 years old, he conjectured that as x goes to infinity, the ratio of $\pi(x)$ to $f(x)$ approaches one. Use Gauss's estimate to estimate the percentage of positive integers smaller than 10^{100} which are prime. (Remark: the natural logarithm of 10 is about 2.3.)

- (A) 10% (B) 3% (C) 0.4% (D) 0.05%

54. Given that $81^m = 3$ and $m^n = 64$. Find the value of mn .

- (A) $-1/2$ (C) $-3/4$
(B) -1 (D) $-1/4$

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55. What is the sum of all the elements of this finite arithmetic sequence

3, 6, 9, 12, 15, 18, ... , 42 ?

- (A) 314 (B) 313 (C) 318 (D) 315

56. The mean, median and mode for this set of data are all equal:

{ x, 68, 30, 58, 52 } . Find x .

- (A) 52 (B) 68 (C) 58 (D) 30

57. In an old Babylonian tablet (circa 1700 B.C.) there is a problem: "A beam of length 30 stands against a wall. The upper end has slipped down a distance 6. How far did the lower end move?" The answer is

- (A) 6 (B) 12 (C) 18 (D) 24

58. Ang produkto ng dalawang buong numero ay 100,000. Kung ang alinman sa mga numero ay hindi multiple ng 10, ano ang kanilang suma(sum) ?

- (A) 3158 (B) 3157 (C) 3159 (D) 3160

59. Solve for x: $\left(\frac{19}{30}\right) + \left(\frac{11}{30}\right)^2 = \left(\frac{19}{30}\right)^2 + x$

- (A) 11/30 (C) 2/5
(B) 1/3 (D) 3/10

60. A triangle with vertices A(0,0), B(8,0), and C(8,6) is graphed in a coordinate plane. The triangular region determined by these points is rotated 360° about the x-axis forming a geometric solid. How many square units are in the total outside area of this geometric solid?

- (A) 90π (C) 120π
(B) 84π (D) 96π