

BROWNSVILLE CITY MATH MEET
JAMES PACE HIGH SCHOOL

MAY 8, 2008



PRE-CALCULUS

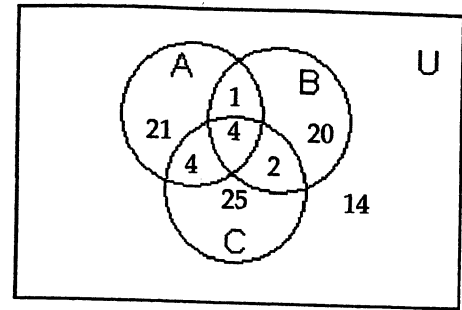
NAME _____

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1. In the figure shown how many are in C complement?

- A) 55
B) 52
C) 56
D) 42



2. In a student survey, 109 students indicated that they speak Spanish, 34 students indicated that they speak French, 12 students said they speak both Spanish and French, and 140 students indicated that they spoke neither. How many students participated in the survey?

- A) 259
B) 271
C) 283
D) 131

3. How many 5-card poker hands consisting of three 3's and two cards that are not 3's are possible in a 52-card deck?

- A) 2256
B) 4512
C) 5304
D) 2652

4. An environmental organization has 24 members. Each member will be placed on exactly one of four teams. Each team will work on a different issue. The first team has five members, the second has seven members, the third has three, and the fourth has nine. In how many ways can these teams be formed?

- A) $3.893049769 \times 10^{19}$
B) $6.204484017 \times 10^{23}$
C) $4.240549273 \times 10^{12}$
D) $4.711721414 \times 10^{11}$

5. Solve the inequality: $\frac{x-5}{2x+8} \geq 8$

- A) $[-\frac{23}{5}, 8)$
B) $[-\frac{23}{5}, 8]$
C) $[-\frac{23}{5}, -4]$
D) $[-\frac{23}{5}, -4)$

6. What is the domain of the function: $f(x) = \sqrt{\frac{x-8}{x+2}}$?
- A) $[8, \infty)$
B) $(-\infty, -2)$
C) $(-\infty, -2) \cup (8, \infty)$
D) $(-\infty, -2) \cup [8, \infty)$
7. If $2 + 3i$ is a zero of $f(x)$, find the remaining zeros for $f(x) = 2x^4 - 13x^3 + 48x^2 - 73x + 26$.
- A) $2 - 3i, 2, \frac{1}{2}$
B) $3 - 2i, -2, -\frac{1}{2}$
C) $2 - 3i, -2, \frac{1}{2}$
D) $3 - 2i, 2, -\frac{1}{2}$
8. Find the sum $1 + 3 + 5 + \dots + 247$.
- A) 15,129
B) 15,500
C) 15,376
D) 15,625
9. Find the sum $\sum_{n=1}^{35} (-3n + 1)$
- A) -1557.5
B) -1855
C) -1680
D) -1802.5
10. Determine whether the infinite geometric series converges or diverges. If it converges, find its sum. $36 + 12 + 4 + \dots$
- A) Converges; -18
B) Converges; 54
C) Converges; 52
D) Diverges

11. Find the fifth and the n th term of the geometric sequence whose initial term, a , and common ratio, r , are given as -2 and -4 , respectively.
- A) $a_5 = -512; a_n = -2 \cdot (-4)^n$
 B) $a_5 = 128; a_n = -2 \cdot (-4)^{n-1}$
 C) $a_5 = 128; a_n = -2 \cdot (-4)^n$
 D) $a_5 = -512; a_n = -2 \cdot (-4)^{n-1}$
12. A hockey player signs a contract with a starting salary of \$810,000 per year and an annual increase of 4.5% beginning in the second year. What will the athlete's salary be, to the nearest dollar, in the sixth year?
- A) \$1,007,930
 B) \$1,011,472
 C) \$1,009,407
 D) \$1,010,363
13. Find the domain of the $f \circ g$, where $f(x) = \sqrt{x-2}$ and $g(x) = \frac{2}{x-10}$.
- A) $\{x \mid x \neq 10, x \neq 2\}$
 B) $\{x \mid x \geq 2, x \neq 10\}$
 C) $\{x \mid 10 < x \leq 11\}$
 D) $\{x \mid x \text{ is any real number}\}$
14. Find the inverse function of f . State the domain and range of f , $f(x) = \frac{3x-2}{x+5}$.
- A) $f^{-1}(x) = \frac{5x+2}{3+x}$; domain of $f : \{x \mid x \neq 5\}$; range of $f : \{y \mid y \neq -3\}$
 B) $f^{-1}(x) = \frac{x+5}{3x-2}$; domain of $f : \{x \mid x \neq -5\}$; range of $f : \left\{y \mid y \neq \frac{2}{3}\right\}$
 C) $f^{-1}(x) = \frac{5x+2}{3-x}$; domain of $f : \{x \mid x \neq -5\}$; range of $f : \{y \mid y \neq 3\}$
 D) $f^{-1}(x) = \frac{3x+2}{x-5}$; domain of $f : \{x \mid x \neq -5\}$; range of $f : \{y \mid y \neq 5\}$

15. Solve for x: $9^{2x} \cdot 27^{(3-x)} = \frac{1}{9}$

A) $\{-11\}$

B) $\{10\}$

C) $\{-8\}$

D) $\left\{\frac{9+\sqrt{87}}{6}, \frac{9-\sqrt{87}}{6}\right\}$

16. Solve for x: $e^{x-2} = \left(\frac{1}{e^5}\right)^{x+1}$

A) $\left\{-\frac{7}{4}\right\}$

B) $\left\{-\frac{1}{2}\right\}$

C) $\left\{-\frac{3}{4}\right\}$

D) $\left\{\frac{1}{2}\right\}$

17. The bacteria in an 8-liter container double every 2 minutes. After 55 minutes, the container is full. How long did it take to fill one quarter of the container?

A) 27.5 min

B) 13.8 min

C) 51 min

D) 41.3 min

18. Express $\ln\left(\frac{x^2 - 6x - 27}{x - 7}\right) - \ln\left(\frac{x^2 - 4x - 21}{x + 7}\right) + \ln(x^2 - 18x + 81)$, $x > 0$, as a single logarithm.
- A) $\ln\frac{(x-9)^3}{(x-7)^2(x+7)}$
 B) $\ln\frac{3(x-9)(x+7)}{2(x-7)}$
 C) $\ln\frac{(x-9)^3(x+7)}{(x-7)^2}$
 D) $\ln\frac{3(x-9)}{2(x-7)(x+7)}$
19. Evaluate the logarithm. Round to two decimal places: $\log_{8.4} 5.7$.
- A) 0.76
 B) 0.68
 C) 1.22
 D) 0.82
20. The letters x and y represent rectangular coordinates. Write the equation $xy = 1$ using polar coordinates (r, θ) .
- A) $2r^2 \sin \theta \cos \theta = 1$
 B) $2r \sin \theta \cos \theta = 1$
 C) $r^2 \sin 2\theta = 2$
 D) $r \sin 2\theta = 2$
21. The letters r and θ represent polar coordinates. Write the equation $r = 2(\sin \theta - \cos \theta)$ using rectangular coordinates (x, y) .
- A) $x^2 + y^2 = 2y - 2x$
 B) $2x^2 + 2y^2 = x - y$
 C) $2x^2 + 2y^2 = y - x$
 D) $x^2 + y^2 = 2x - 2y$

22. Find zw where $z = 2 + 2i$ and $w = \sqrt{3} - i$. Leave your answer in polar form.

A) $4\sqrt{2}\left[\cos\left(\frac{\pi}{12}\right) + i\sin\left(\frac{\pi}{12}\right)\right]$

B) $4\left[\cos\left(\frac{23\pi}{12}\right) + i\sin\left(\frac{23\pi}{12}\right)\right]$

C) $4\left[\cos\left(\frac{\pi}{12}\right) + i\sin\left(\frac{\pi}{12}\right)\right]$

D) $4\sqrt{2}\left[\cos\left(\frac{23\pi}{12}\right) + i\sin\left(\frac{23\pi}{12}\right)\right]$

23. Write the expression $(\sqrt{3} + i)^5$ in the standard form $a + bi$.

A) $16 - 16\sqrt{3}i$

B) $-16\sqrt{3} + 16i$

C) $9\sqrt{3} + 5i$

D) $16\sqrt{3} - 16i$

24. Find the complex fifth roots of $(\sqrt{3} + i)$. Leave your answers in polar form with the argument in degrees.

A) $\sqrt[5]{2}(\cos 30^\circ + i\sin 30^\circ), \sqrt[5]{2}(\cos 102^\circ + i\sin 102^\circ), \sqrt[5]{2}(\cos 174^\circ + i\sin 174^\circ),$
 $\sqrt[5]{2}(\cos 246^\circ + i\sin 246^\circ), \sqrt[5]{2}(\cos 318^\circ + i\sin 318^\circ).$

B) $32(\cos 30^\circ + i\sin 30^\circ), 32(\cos 102^\circ + i\sin 102^\circ), 32(\cos 174^\circ + i\sin 174^\circ),$
 $32(\cos 246^\circ + i\sin 246^\circ), 32(\cos 318^\circ + i\sin 318^\circ).$

C) $\sqrt[5]{2}(\cos 6^\circ + i\sin 6^\circ), \sqrt[5]{2}(\cos 78^\circ + i\sin 78^\circ), \sqrt[5]{2}(\cos 150^\circ + i\sin 150^\circ),$
 $\sqrt[5]{2}(\cos 222^\circ + i\sin 222^\circ), \sqrt[5]{2}(\cos 294^\circ + i\sin 294^\circ).$

D) $32(\cos 6^\circ + i\sin 6^\circ), 32(\cos 78^\circ + i\sin 78^\circ), 32(\cos 150^\circ + i\sin 150^\circ),$
 $32(\cos 222^\circ + i\sin 222^\circ), 32(\cos 294^\circ + i\sin 294^\circ).$

25. Use properties of determinants to find the value of the second determinant, if the value of the first is known.

$$\begin{vmatrix} x & y & z \\ u & v & w \\ 1 & -1 & -2 \end{vmatrix} = -16 : \begin{vmatrix} 1 & -1 & -2 \\ 3u & 3v & 3w \\ x-1 & y+1 & z+2 \end{vmatrix} = ??$$

- A) 16
- B) -48
- C) 48
- D) -16

26. The final grade for an algebra course is determined by grades on the midterm and final exams. The grades for four students and two possible grading systems are modeled by the following matrices.

	Midterm	Final
Student 1	73	79
Student 2	44	62
Student 3	76	89
Student 4	98	96
	System 1	System 2

Midterm	0.3	0.5
Final	0.7	0.5

Find the final course score for student 3 for both grading System 1 and System 2.

- A) System 1: 44.2; System 2: 53
- B) System 1: 77.2; System 2: 76
- C) System 1: 85.1; System 2: 82.5
- D) System 1: 67.3; System 2: 97.7

27. For the matrices shown below, find $C(A - B)$.

$$A = \begin{bmatrix} 0 & -1 \\ 6 & 0 \\ 3 & 4 \end{bmatrix}, B = \begin{bmatrix} -4 & 0 \\ 1 & 1 \\ 4 & 6 \end{bmatrix}, \text{ and } C = \begin{bmatrix} -3 & 1 & 6 \\ 0 & -4 & -1 \end{bmatrix}$$

A) $\begin{bmatrix} -30 & 5 \\ 20 & 0 \end{bmatrix}$

B) $\begin{bmatrix} -13 & -2 \\ 12 & -9 \end{bmatrix}$

C) $\begin{bmatrix} -13 & -10 \\ -19 & 6 \end{bmatrix}$

D) $\begin{bmatrix} 12 & -9 \\ -13 & -2 \end{bmatrix}$

28. Write the partial fraction decomposition of the rational expression

$$\frac{11x+1}{x^3-1}$$

A) $\frac{4}{x-1} + \frac{-4}{x^2+1} + \frac{3}{x-1}$

B) $\frac{-4}{x-1} + \frac{4x+3}{x^2+x+1}$

C) $\frac{4}{x-1} + \frac{-4x+3}{x^2+x+1}$

D) $\frac{4}{x-1} + \frac{3x-4}{x^2+x+1}$

29. Solve the system of equations:
$$\begin{cases} 2x^2 + xy - y^2 = 3 \\ x^2 + 2xy + y^2 = 3 \end{cases}$$

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

30. The area of a rectangular garden is 6000 square feet and the length of its diagonal is 130 feet. Find the dimensions of the garden.

- A) 5 ft by 1200 ft
B) 500 ft by 12 ft
C) 50 ft by 120 ft
D) 60 ft by 100 ft

31. Given that $\sin \theta = \frac{\sqrt{5}}{3}$ and $\cos \theta = \frac{2}{3}$, find $\cot \theta$.

- A) $\frac{3}{2}$
B) $\frac{3\sqrt{5}}{5}$
C) $\frac{\sqrt{5}}{2}$
D) $\frac{2\sqrt{5}}{5}$

32. An experiment in a wind tunnel generates cyclic waves. The following data is collected for 32 seconds:

Time (in seconds)	Wind Speed (in ft/sec)
0	13
8	43
16	73
24	43
32	13

Let V represent the wind speed (velocity) in feet per second and let t represent the time in seconds. Write a sine equation that describes the wave.

- A) $V = 73 \sin\left(\frac{\pi}{16}t - \frac{\pi}{2}\right) + 13$
 B) $V = 60 \sin(32t - 16) + 30$
 C) $V = 30 \sin\left(\frac{\pi}{16}t - \frac{\pi}{2}\right) + 43$
 D) $V = 73 \sin(32t - 16) + 13$
33. Find the exact value of the expression $\cos^{-1}\left(\cos\left(-\frac{5\pi}{4}\right)\right)$ without the use of a calculator.

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

34. Find the exact value of the expression $\cos(\cos^{-1}(-4))$ without the use of a calculator.

- A) 1
 B) -4
 C) 4
 D) Not defined

35. Find the exact solution of the equation: $-3 \sin^{-1}(2x) = \pi$.

A) $x = -\frac{1}{4}$

B) $x = \frac{\sqrt{3}}{4}$

C) $x = \frac{\sqrt{2}}{4}$

D) $x = -\frac{\sqrt{3}}{4}$

36. Solve the equation $\csc^5 \theta - 4 \csc \theta = 0$ on the interval $0 \leq \theta < 2\pi$.

A) $\frac{\pi}{4}, \frac{5\pi}{4}, \frac{\pi}{3}, \frac{5\pi}{3}$

B) $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{\pi}{3}, \frac{5\pi}{6}$

C) $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{\pi}{6}, \frac{5\pi}{6}$

D) $\frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{3}, \frac{7\pi}{3}$

37. A water wheel rotates through the angle θ , the water level, L , behind the wheel changes according to the equation $L = 1 - \sin \theta - 2 \cos^2 \theta$, where L is measured in inches. Determine the values of θ for which the water level is zero.

A) $\frac{\pi}{2}, \frac{7\pi}{6}, \frac{11\pi}{6}$

B) $\frac{\pi}{6}, \frac{\pi}{3}, \pi$

C) $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

D) No solution.

38. Solve the equation $\cos(2\theta) + 6\sin^2 \theta = 2$ on the interval $0 \leq \theta < 2\pi$.

A) $\frac{\pi}{6}, \frac{5\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}$

B) $\frac{\pi}{3}, \frac{5\pi}{3}$

C) $\frac{\pi}{6}, \frac{5\pi}{6}$

D) $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}, \frac{5\pi}{3}$

39. Solve the equation $\sin(2\theta) - \sin(4\theta) = 0$ on the interval $0 \leq \theta < 2\pi$.

A) $0, \frac{\pi}{3}, \frac{\pi}{2}, \frac{2\pi}{3}, \pi, \frac{4\pi}{3}, \frac{3\pi}{2}, \frac{5\pi}{3}$

B) $0, \frac{\pi}{6}, \frac{\pi}{2}, \frac{5\pi}{6}, \pi, \frac{7\pi}{6}, \frac{3\pi}{2}, \frac{11\pi}{6}$

C) $0, \frac{\pi}{3}, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, \frac{5\pi}{3}$

D) $0, \frac{\pi}{6}, \frac{\pi}{2}, \pi, \frac{3\pi}{2}, \frac{11\pi}{6}$

40. Solve the equation $\sin(\theta) = -\sqrt{2} - \cos(\theta)$ on the interval $0 \leq \theta < 2\pi$.

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

B) $\frac{\pi}{4}$

C) $\frac{5\pi}{4}$

D) $\frac{3\pi}{2}$

41. A ship sailing parallel to shore sights a lighthouse at an angle of 14° from its direction of travel. After traveling 4 miles further, the angle is 25° . At that time, how far is the ship from the lighthouse?

A) 4 mi

B) 8.86 mi

C) 5.07 mi

D) 2.29 mi

42. It is 4.7nm from Lighthouse A to Port B. The bearing of the port from the lighthouse is $N73^\circ E$. A ship has sailed due west from the port and its bearing from the lighthouse is $N31^\circ E$. How far has the ship sailed from the port?
- A) 2.7 nm
 - B) 3.5 nm
 - C) 3.7 nm
 - D) 3.1 nm
43. Find the area of the Bermuda Triangle if the sides of the triangle have the approximate lengths 849 miles, 927 miles, and 1320 miles.
- A) 1,565,659 mi
 - B) 391,415 mi
 - C) 496,233 mi
 - D) 517,257 mi
44. A new homeowner has a triangular-shaped back yard. Two of the three sides measure 65 ft and 80 ft and form an included angle of 125° . The owner wants to approximate the area of the yard so that he can determine the amount of fertilizer and grass seed he needs to buy. Find the area of the yard to the nearest square foot.
- A) 2129 sq. ft
 - B) 4260 sq. ft
 - C) 2130 sq. ft
 - D) 5200 sq. ft
45. Determine whether the given information $[C = 35^\circ, a = 18.7, c = 16.1]$ results in one, two, or no triangle(s). Solve any triangle(s) that result.
- A) 1 Δ . $A = 42^\circ, B = 103^\circ, b = 27.4$
 - B) 2 Δ . $A_1 = 103^\circ, B_1 = 42^\circ, b_1 = 27.4$
 $A_2 = 7^\circ, B_2 = 138^\circ, b_2 = 3.4$
 - C) 2 Δ . $A_1 = 42^\circ, B_1 = 103^\circ, b_1 = 27.4$
 $A_2 = 138^\circ, B_2 = 7^\circ, b_2 = 3.4$
 - D) no triangle

46. Solve the triangle if $b = 7, c = 9, A = 122^\circ$.

- A) $a = 19.8, B = 23^\circ, C = 35^\circ$
- B) $a = 16.9, B = 27^\circ, C = 31^\circ$
- C) $a = 14, B = 25^\circ, C = 33^\circ$
- D) no triangle

47. Solve the triangle if $a = 19, b = 16, c = 11$.

- A) $A = 57.3^\circ, B = 87.4^\circ, C = 35.3^\circ$
- B) $A = 35.3^\circ, B = 57.3^\circ, C = 87.4^\circ$
- C) $A = 87.4^\circ, B = 35.3^\circ, C = 57.3^\circ$
- D) $A = 87.4^\circ, B = 57.3^\circ, C = 35.3^\circ$

48. The altitude of an isosceles triangle drawn to its base is three feet and the perimeter is eighteen feet. Find the length of the base.

- A) 4 ft
- B) $4\sqrt{2}$ ft
- C) 16 ft
- D) 8 ft

49. Solve the inequality: $x^2 + 11x + 30 > 0$.

- A) $(-5, \infty)$
- B) $(-6, -5)$
- C) $(-\infty, -6)$
- D) $(-\infty, -6) \cup (-5, \infty)$

50. Write the vector \vec{v} in the form $a\vec{i} + b\vec{j}$, given its magnitude $\|\vec{v}\| = 15$ and the angle, α , it makes with the positive x-axis is 135° .

A) $\vec{v} = -\frac{15\sqrt{2}}{2}\vec{i} + \frac{15\sqrt{2}}{2}\vec{j}$

B) $\vec{v} = -\vec{i} - \frac{15}{2}\vec{j}$

C) $\vec{v} = \frac{\sqrt{2}}{2}\vec{i} - \frac{\sqrt{2}}{2}\vec{j}$

D) $\vec{v} = -\frac{15}{2}\vec{i} + \frac{15\sqrt{3}}{2}\vec{j}$

