

Pre-Calculus Individual – March 18, 2000  
Palm Harbor University High School Invitational

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(The Abbreviation NOTA denotes None Of The Above)

1) Find the equation for the line that is the perpendicular bisector of the line segment between the points  $(-3,5)$  and  $(2,15)$ .

A)  $y = \frac{1}{2}x + 11$    B)  $y = 3x + 5$    C)  $y = 2x + 15$    D)  $y = -\frac{1}{2}x + \frac{39}{4}$    E) NOTA

2) On an analog clock, what is the arc length (total distance) that the minute hand travels *through* between 1 p.m. and 5:48 p.m. on the same day, assuming that the minute hand is 4.5 inches and the hour hand is 3 inches?

A)  $\frac{188\pi}{5}$  inches   B)  $\frac{216\pi}{5}$  inches   C)  $\frac{144\pi}{5}$  inches   D)  $\frac{119\pi}{60}$  inches  
E) NOTA

3) Which of the following have exactly 2 real roots?

i)  $f(x) = x^2 + 22x - 3360$    ii)  $g(x) = 6x^3 + 29x^2 - 96x - 35$   
iii)  $h(x) = x^4 - 13x^3 + 65x^2 - 151x + 130$    iv)  $j(x) = 9x^2 + 38x + 54$

A) i, ii   B) ii, iv   C) i, iii   D) i, ii, iv   E) NOTA

4) At a point 3 meters from the center of a merry-go-round, the linear velocity is 8 meters/second. Find the linear velocity of the merry-go-round 7 meters from the center.

A)  $\frac{56}{3} m/s$    B)  $56 m/s$    C)  $\frac{21}{8} m/s$    D)  $21 m/s$    E) NOTA

5) Find a unit vector for  $4i + 6j + 10k$ .

A)  $\frac{2\sqrt{5}}{5}i + \frac{3\sqrt{5}}{5}j + \sqrt{5}k$    B)  $\frac{\sqrt{38}}{19}i + \frac{3\sqrt{38}}{38}j + \frac{5\sqrt{38}}{38}k$   
C)  $\frac{\sqrt{15}}{15}i + \frac{\sqrt{15}}{10}j + \frac{\sqrt{15}}{6}k$    D)  $4i + 6j + 10k$    E) NOTA

6) The binomial  $(x+y)^{25}$  is expanded. Find the sum of the coefficients of the 4<sup>th</sup> and 16<sup>th</sup> terms.

- A) 3,271,060    B) 2,055,625    C) 4,470,050    D) 4,459,700    E) NOTA

7) Given  $f(x+1) = (2x^2 + 32x + 128)(x-4)$ . Find the sum of the roots of  $f(x)$ .

- A) -21    B) -9    C) -15    D) -2    E) NOTA

8) Evaluate  $\lim_{x \rightarrow -\frac{1}{2}} \frac{-6x^2 + 7x + 5}{x + \frac{1}{2}}$

- A) 13    B)  $\frac{\sqrt{677}}{2}$     C)  $\frac{13}{2}$     D)  $\frac{15\sqrt{3}}{2}$     E) NOTA

9) Given a 3 X 3 matrix, B, with the following terms:  $a_{11} = 1$ ,  $a_{12} = 2$ ,  $a_{13} = 0$ ,  $a_{21} = 4$ ,  $a_{22} = 0$ ,  $a_{23} = 1$ ,  $a_{31} = 9$ ,  $a_{32} = 2$ ,  $a_{33} = 3$ . (Note:  $a_{11}$  means row 1, column 1) Find determinant of  $(B^2)$ .

- A) 9    B) 25    C) 64    D) 81    E) NOTA

10) Evaluate:  $\sum_{n=5}^{150} n^3$

- A) 128,255,625    B) 128,255,525    C) 128,255,400  
D) 128,255,475    E) NOTA

11) Find the slope of the tangent line of  $(2x^2 + 5x + 6)^2$  at  $x=7$ .

- A) 19,321    B) 1,089    C) 33    D) 9,174    E) NOTA

12) Find the slope of the secant line that passes through the point (20, 906) and the point  $x=7$  on the parabola  $y=2x^2 + 5x + 6$ .

- A) 75    B) 68    C) 59    D) 45    E) NOTA

13) What is the tens digit of  $13^{453}$ ?

- A) 1      B) 5      C) 9      D) 8      E) NOTA

14)  $\lambda$  is the value that will make the angle between the following vectors  $30^\circ$ :  $3i-4j+12k$  &  $-6i+2j+\lambda k$ . If  $\lambda$  is expressed in simplest form  $\frac{a\sqrt{b}+c}{d}$ , what is the sum of a, b, c, and d?

- A) 693,881      B) 6,784      C) 4,241      D) 5,441      E) NOTA

15) Given:  $f(x) = \sqrt{x+1}$  &  $g(x) = \frac{2x^2}{3-x}$  Find the domain of  $(f \circ g)(x)$ .

- A)  $(-\infty, 3)$       B)  $(-\infty, 8) \cup (8, \infty)$       C)  $(5, 13]$       D)  $(-\infty, 9]$       E) NOTA

16) The dot product of  $6i+5j-2k$  with  $\Omega i+7j-11k$  is 111. Find  $\Omega$ .

- A) 11      B) 6      C) 8      D) 9      E) NOTA

17) A survey crew is standing 3000 ft. from a building. The angle of elevation is  $37^\circ$ . Find the height of the building to the nearest yard.

- A) 754 yd.      B) 602 yd.      C) 1327 yd.      D) 799 yd.      E) NOTA

18) Find the measure of the smaller dihedral angle (to the nearest degree) between the following two planes:

Plane 1:  $2x-3y+5z+14=0$       Plane 2:  $4x-y+z+35=0$

- A)  $59^\circ$       B)  $31^\circ$       C)  $38^\circ$       D)  $52^\circ$       E) NOTA

19) Find the acute angle (to the nearest tenth of a degree), between the line  $y = \frac{4}{5}x + 3$ , and the x-axis.

- A)  $51.3^\circ$       B)  $36.9^\circ$       C)  $38.7^\circ$       D)  $53.1^\circ$       E) NOTA

20) The graph of a degenerate ellipse is a/an ...

- A) line    B) ellipsoid    C) point    D) pair of lines    E) NOTA

21) Find the product of the values of  $x$  that satisfy this equation:

$$(\log x)^2 - 6 \log x = 7$$

- A) 1000    B)  $1000\sqrt{2}$     C) 1000000    D)  $1000000\sqrt{2}$     E) NOTA

22) Simplify:  $\frac{\sin x}{1 - \cos x} + \frac{1 - \cos x}{\sin x} - \tan x$

- A)  $\frac{2(\cos x + \sin x)}{\sin x \cos x}$     B)  $\frac{\cos x + \sin^2 x}{\sin x \cos x}$     C)  $\frac{2 \cos x - \sin^2 x}{\sin x \cos x}$     D)  $\frac{\cos^2 x + 2 \sin x}{\sin x \cos x}$   
E) NOTA

23) Given  $\begin{vmatrix} 4 & 9 & 2 \\ a & 3 & 8 \\ 7 & 6 & 1 \end{vmatrix} = 297$ . Find  $2a$

- A) 10    B) 16    C) 12    D) 4    E) NOTA

24) Given  $\log_2 \alpha = \log_4 \alpha^2$ , Find all solutions.

- A) All Integers    B) 4    C) 1    D) All Real Numbers    E) NOTA

25) The graph of the polar equation  $r = 17 \csc \theta$  is a...

- A) parabola    B) line    C) hyperbola    D) circle    E) NOTA

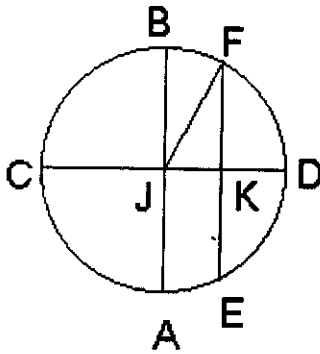
26) Find the equation of the parabola that has (4,7) as a vertex and a directrix at  $x=3$ .

- A)  $x^2 - 14x - y + 53 = 0$     B)  $y = \sqrt{x + 14y - 53}$     C)  $x^2 + 13y - 65 = 0$   
D)  $y^2 - 4x - 14y + 65 = 0$     E) NOTA

27) Given:  $f(x) = \frac{6x^2 - 3x - 45}{2x + 5}$  Find  $f'(x)$ .

- A)  $\frac{6x^2 - 3x - 45}{(2x + 5)^2}$  B)  $\frac{(6x^2 - 3x - 45)^2}{2x + 5}$  C)  $\frac{12x - 3}{(2x + 5)^2}$  D)  $\frac{12x - 3}{2}$  E) NOTA

28) The following unit circle has J as its center,  $\overline{AB}$  and  $\overline{CD}$  ( $\overline{AB} \perp \overline{CD}$ ) as its diameters, and  $\overline{FE} \perp \overline{CD}$  as a chord ( $\overline{FE}$ ). What trigonometric function is represented by  $FJ/JK$  (with respect to  $\angle FJD$ )?



- A) secant  
B) cosecant  
C) sine  
D) cosine  
E) NOTA

29) Find  $(a+b)$  in the quadratic function (in the form of  $f(x) = ax^2 + bx + c$ ) that contains the following points:  $(1, 8)$ ,  $(4, 47)$ , and  $(6, 103)$ .

- A) 4 B) 3 C) 2 D) 1 E) NOTA

30)  $\begin{bmatrix} 4 & 7 \\ 5 & 2 \end{bmatrix} \begin{bmatrix} 9 & F \\ G & 3 \end{bmatrix} = \begin{bmatrix} 50 & 28 \\ 49 & 14.75 \end{bmatrix}$  Find  $G - F$ .

- A) .25 B) .35 C) -.45 D) .95 E) NOTA