January Regional **_Answer Key_** **_Pre-Calculus Tests_**

Individual Test

1	A
2	A
3	B
4	C
5	B
6	D
7	C
8	D
9	A
10	D
11	C
12	D
13	B
14	C
15	D
16	A
17	E
18	D
19	A
20	D
21	C
22	B
23	C
24	B
25	B
26	C
27	B
28	A
29	D
30	C

Team Test

1	10
2	290.08
3	242
4	158
5	889
6	-35
7	17
8	$\frac{11\pi}{6}$
9	1
10	22
11	22.5 or $\frac{45}{2}$
12	-5233.6
13	4
14	2009010
15	$8\sqrt{2cis(285^\circ)}$

January Regional ***SOLUTIONS*** ***Pre-Calculus Individual Test***

1. A. The minimum value occurs at x = $\frac{-b}{2a} = \frac{16}{4} = 4$. So the minimum value occurs at f(4) = -25, A.

2. A. Determinant of the matrix is 12(k + 1). So set 12(k + 1) = -2k + 4. Solve for k = $\frac{-4}{7}$. 7k = -4, A.

3. B. Use A = Pe^{rt}, so \$1,000,000 = $Pe^{(0.065*20)}$. Solve for P = 272, 531.79, or \$272,532, B.

4. C. As x approaches 0, the lengths of the arc and the vertical line segment are getting closer and closer to each other. Thus the ratio $\frac{\sin(x)}{x}$ seems to be approaching 1., so C.

5. B. Rewrite as $\frac{\frac{1}{\tan}\frac{1}{\cos^2}}{\frac{1}{\cos}} = \frac{1}{\tan}\frac{1}{\cos^2}(\cos) = \frac{1}{\tan}\frac{1}{\cos} = \frac{\cos}{\sin}\frac{1}{\cos} = \frac{1}{\sin}$ = cosecant, B.

6. D. Multiply the top equation by (+4) and the bottom equation by (-3) and add. The result is: 25y = 75. Thus y = 3. Substitute in to find that x = -2. Thus 3 + -2 = 1, D.

7. C. Translate to y = kcos(3x). Use the given (x,y) to find that $\frac{-3\sqrt{2}}{2} = k\cos\left(\frac{3\pi}{4}\right)$, so k = 3. So now y = 3cos(3x). So when y = -3, use -3 = 3cos(3x) and solve for x. -1 = cos(3x), $x = \frac{\pi}{3}$, C.

8. D. The slope of the given line is found when $y = \frac{5}{2}x + \frac{3}{2}$, so m = 5/2. Perpendicular lines will then have a slope of $\frac{-2}{5}$. Use the point slope formula to find your new line has the equation (y – 7) = $\frac{-2}{5}$(x-4). The y-intercept occurs when x = 0, thus (y – 7) = $\frac{-2}{5}$(0-4). So y = $\frac{43}{5}$, D.

9. A. The dot product is given by (2)(0) + (5)(-2)+ (-1)(4) = -14, A.

10. D. The cross product can be found using $\begin{vmatrix} 2 & 5 & -1 \\ 0 & -2 & 4 \\ i & j & k \end{vmatrix}$ = 18i – 8j – 4k, D.

11. C. The angle between vectors can be found as $\cos(\phi) = \frac{u \bullet v}{\|u\|\|v\|} = \frac{-14}{\sqrt{30}\sqrt{20}} = -.5715$ Thus ϕ = 124.85, or 125°, C.

12. D. Use the remainder theorem: Remainder when dividing by (x-2) is the function evaluated at x = 2, thus 77, D.

13. B. This can be rewritten as $x = \sqrt{30 - x}$. Only +5 serves as a solution, Thus B.

14. C. Substitute in (x-1) to find that f(x) = cos(x) + 2x + 7 (drop the π inside cos() by trig Ids). Thus $\pi + 7 = \cos(T) + 2T + 7$. Thus T = $\frac{\pi}{2}$, C.

15. D. -727° lies the same as a -7° angle. An angle of +353° has the same terminal side, so D.

16. A. Each term is one-third the prior term. The 14th term in the sequence corresponds to $\left(\frac{1}{3}\right)^9$ or 19683^{-1}, or A.

17. E. None satisfy –f(x) = f(-x), the condition of an odd function (also: symmetric about the origin)

18. D. r=cos(θ) is a circle centered at (0.5, 0) with radius 0.5. Thus only choice D is the correct form in Cartesian.

19. A. v(-1) = $(-1)^3$ = -1. w(-1) = $(-1)^{-1}$ = -1. u(-1) = 3(-1) + 2 = -1, thus A.

20. D. Use de Moivre's identity: $(1+i)^9 = \sqrt{2}^9\left(\cos\left(9\frac{\pi}{4}\right) + i\sin\left(9\frac{\pi}{4}\right)\right)$ = 16 + 16i, D.

21. C. tan(2x) has its asymptotes shifted from tan(x) so they occur at all odd multiples of $\frac{\pi}{4}$, thus $\frac{n\pi}{4}$.
22. B. $434\left(\frac{\pi}{180}\right)$ = 7.574728...or 7.6, B.
23. C. $5cis(45^\circ) = 5(\cos 45 + i\sin 45) = \frac{5\sqrt{2}}{2} + \frac{5i\sqrt{2}}{2}$. Thus $\frac{5\sqrt{2}}{2} + \frac{5\sqrt{2}}{2} = 5\sqrt{2}$ or C.
24. B. $\sqrt{-3}\sqrt{-27} = i\sqrt{3}i\sqrt{27} = i^2\sqrt{81} = 9i^2 = -9$, B
25. B. Use log change of base formula, and everything cancelled out except $\frac{\log T}{\log A} = \log_A T$, B.
26. C. As x gets infinitely larger, $\frac{1}{x}$ gets infinitely smaller, so $1 - \frac{1}{x}$ gets closer to 1. Thus limit = 1, C.
27. B. $\begin{bmatrix} 1 & 2 \\ 2 & 1 \end{bmatrix}^{-1} = \begin{bmatrix} -1/3 & 2/3 \\ 2/3 & -1/3 \end{bmatrix}$. Determinant yields $\frac{-1}{3}$ or B.
28. A. Use the conjugate. $\frac{3-5i}{2+7i} = \left(\frac{3-5i}{2+7i}\right)\left(\frac{2-7i}{2-7i}\right) = simplify = \frac{-29-31i}{53}$, A.
29. D. As x goes to 4 from the right, the problem reduces to $\frac{2 \bullet 7}{6 \bullet 1 \bullet Q}$ where Q is approaching zero positively. Thus dividing by a smaller and smaller number causes the magnitude of the function to increase dramatically, and since it is > 0, all the numbers are positive, thus the function goes to positive infinity, D.
30. C. Choices A&B have amplitudes to large. Only choice C has the correct amplitude, and the +2 shifts it to the correct range.