Pre-Calc Team Solutions **February 2005**

1. AB = DE = 29, DF = 19, $\angle C = \angle F = 30^0$ so using the law of sines $\angle E = 19.12^0$. So $\angle D = 180 - 30 - 19.12 = 130.88^0$ converted to rads = **2.3 rads**
2. Using $\cos^2 x = 1 - \sin^2 x$, we get $2(\sin x - 4\sin^2 x) = 0$ and factoring out sin x gives that the equation is true when sin x = 0, so there is 5 values of x between 0 and 720. There is also 4 values of x that solve $(1 - 4\sin x) = 0$. So there is a total of **9**
3. The dot product of A and B is $-2b(a^2 - a + b)$ and the bottom sums up to $a^2 - a + b$ so the answer is **–2b**
4. Det M is 579 so M^{-1} is $\begin{bmatrix} 1/193 & 24/193 \\ -8/579 & 1/579 \end{bmatrix}$ so, 3 M^{-1} is $\begin{bmatrix} 3/193 & 72/193 \\ -8/193 & 1/193 \end{bmatrix}$ so det 3 M^{-1} is **3/193**
5. $A = 1/2 \left\| \begin{bmatrix} 1 & 6 & 1 \\ 5 & 3 & 1 \\ 0 & -3 & 1 \end{bmatrix} \right\|$ = **39/2**
6. $x = \sqrt{3-x} \Rightarrow x^2 + x - 3$ and using the quadratic formula we get $x = \frac{-1+\sqrt{13}}{2}$
7. $50 = 2000\,(1/2)^{10/x} \Rightarrow x = \frac{10\ln 2}{\ln 40}$ so solving for t in $4 = 2000\,(1/2)^{t/x}$ we get t = 17 years so 17 – 10 = **7 years**
8. statement 1 is true +1
   statement 2 is false (cardiod) +1 – 2 = -1
   statement 3 is false (3 petals) –1 – 3 = -4
   statement 4 is false (the equation is less by one so it is not an ellipsoid) –4 – 4 = -8
   statement 5 is true (the answer is -1) –8 + 5 = -3
   statement 6 is false (sin in not a even function) –3 – 6 = -9
   statement 7 is false (the answer should be 3/2) –9 – 7 = -16
   statement 8 is true –16 + 8 = -8

9. $A = \frac{4/3}{1-2/3} = 4$
   $B = 3\,e^{\ln 7} = 3 * 7 = 21$
   C = 2004 = 2 * 2 * 3 * 167, so there are 3 prime factors of 2004
   $D = \frac{(x+2)^2}{1} + \frac{(y+1)^2}{3} = 1$ so the x coordinate of the center is -2
   $\frac{C+B}{AD} = \frac{3+21}{4*-2} =$ **-3**

10. The time it takes to find how long for the rock to hit the ground can be solved using the equation: $y = v\,t\sin\theta - 1/2\,g\,t^2 \Rightarrow -200 = 100 * t * ½ - ½ * 9.8 * t^2 \Rightarrow$ solving for t yields t = 13.27805s. So the rock traveled $v * t * \cos\theta \Rightarrow$ **1149.9 m.**
11. The area of the circle is 4^2 * pi = 16 pi. The largest triangle is the one half the largest rectangle and the largest rectangle is a square. So the largest triangle will have the legs equal 8 pi each, so the area will be 8 pi * 8 pi * ½ = **32 pi ^ 2.**

12. For A: lets set A = abcd. We know that a+b+c+d = 6, and a = ½ * d and a+c = 2, so 2a + b = 4. If b = a, a = 4/3. If b = d, a = 1, b = 2, c= 1, and d = 2, which can not be true because only two are the same. So b = c, and a = 2, so b = 0, c = 0, and d = 4, so A = 2004.
For B: c is the number correct and i is the number incorrect. c + i = 50 and 4c – i = 172, solving the equations: i = 13
So A + B = 2004 + 13 = **2017**

13. One revolution equals 2 pi *r = 26 pi in. One mile equals 5280 * 12 in. = 63360 in. So there are 1,900,800,000 inches in 3,000 miles. Divide by 26 pi and get **2,327,090 complete revolutions.**

14. x = r cos θ and y = r sin θ so convert to polar ⇒ $\mathbf{r^2 \cos^2 \theta + r \sin \theta - 2 r \cos \theta + 2}$

15. $.8 = ½^{t/2000}$ ⇒ ln .8 = t/2000 ln ½ ⇒ t = 2000 * ln .8 / ln ½ ⇒ 643.856 ⇒ **644 years**

Pre-calc Team Answers: **February 2005**

1) 2.3
2) 9
3) –2b
4) 3/193
5) 39/2
6) $\dfrac{-1+\sqrt{13}}{2}$
7) 7
8) –8
9) –3
10) 1149.9 m
11) 32 pi ^ 2
12) 2017
13) 2,327,090
14) $r^2 \cos^2\theta + r\sin\theta - 2r\cos\theta + 2$
15) 644 years