I “lied”. **There are ten multiple choice** questions worth 1 point and **four Maple tasks** worth 2.5 points: **for a total of 20 points.**

**Part A: Multiple Choice: answer on this paper**

1. The area under the graph of \( y = \cos(x) + \frac{1}{\pi} \) for \( 0 < x < \frac{\pi}{2} \) is
   
   A. 0  
   B. \( \frac{\pi}{2} \)  
   C. 3/2  
   D. \( \frac{3\pi}{2} \)

2. What is the output of the following Maple statement?
   
   > evalf(Int(x^3*sqrt(x^4+1),x=0..3^(1/4)));

   A. 0.0000000000  
   B. 1.3333333333  
   C. 1.1414213562  
   D. 1.1666666667

3. The graph of \( y = 1/(4 + x^2) \) is concave down for the interval
   
   A. \([-2,2]\)  
   B. \([-\sqrt{3},\sqrt{3}]\)  
   C. \([-2\sqrt{3},2\sqrt{3}]\)  
   D. None of these

4. The value of the integral
   
   \( \int_{-1}^{1} (4x + 3)^3 \, dx \)

   is  
   A. 105  
   B. 150  
   C. 165  
   D. -150

5. \[
   \lim_{n \to \infty} \sum_{i=1}^{n} \left( \frac{1 + \frac{i}{n}}{2} \right)^2 \frac{1}{n}
   \]

   is  
   A. -1  
   B. 0  
   C. 1  
   D. 14/3
6. Let \( f(x) = \int_{\pi}^{x} \sqrt{\sin(t) + 3 \cos(2t)} \, dt \). What is \( f'(0) \)?

A. 0 B. \( \pi \) C. \( x \) D. None of these

7. The graph of \( y = \frac{\sqrt{x^4 + 5x + 1}}{3x^2 - 1} \) has a vertical asymptote at:

A. \( x = 3 \) B. \( x = \frac{1}{\sqrt{3}} \) C. \( y = 3 \) D. \( y = -\frac{1}{\sqrt{3}} \) E. Nowhere

8. The graph of \( y = x^4 - 2x^2 + 7 \) is increasing precisely on

A. \((-1,0)\) B. \((1,\infty)\) C. \((-1,0) \) and \((1,\infty)\) D. None of these sets

9. What is the output of the following Maple statement?

\[
> \text{convert}\left(\{\text{op}\left(\left[\text{seq}(k,k=1..12)\right]\right)\} \cap \{\text{op}\left(\left[\text{seq}(2*k,k=1..5)\right]\right)\},\text{list}\};
\]

A. \( [2,4,6,8,10] \) B. \( \{2,4,6,8,10\} \) C. \( \{2,4,6,8,10,12\} \) D. \( [2,4,6,8,12] \)

10. These multiple choice questions were

A. Fair B. Too hard C. Too Easy D. About right
Part B: Maple Tasks. Open a Maple session and record your work. We will collect the work sheets at the end of the two hours (or earlier if you so wish).

1. Compute the first prime number after each power of ten for $1<k<50$. (For $k=1$, the answer is 11).

2. Write Maple to display the $n$-times-$n$ matrix $A(n)$ with $i,j$ entry

$$(-1)^{i+1} \binom{2n-j}{i-j}$$

Here $\binom{n}{m}$ is the binomial coefficient. Now compute the following three matrices

$A(7)$, $A(8)^2$, and $A(9)^3$

3. Write Maple expression to display and then simplify

$$(1 + x)(1 + x^2)(1 + x^4) \cdots (1 + x^n)$$

for $n=0,1,2,3,\ldots$. What is the limit of the expression above for $|x|<1$ as $n \to \infty$?

4. Consider the "identity"

$$\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^n} = \int_0^1 x^\nu dx$$

First, confirm this identity numerically to 20 places in Maple. Then prove it symbolically.