Due: Monday, November 28th, 2005.

1. Create a Maple worksheet which computes each of the following. Unless otherwise indicated, provide your answers in exact form, simplified as much as possible. Pass in a hard copy of your worksheet, and submit it electronically using the `math2120` command.

   (a) Determine $\dfrac{d^9 f(x)}{dx^9}$ where $f(x) = \sin(x)\cos^2(x)$.

   (b) Evaluate the derivative in part (a) at $x = \dfrac{\pi}{3}$.

   (c) Find all roots (real or complex) of $3x^4 + 13x^3 + 137x^2 + 637x - 490$.

   (d) Evaluate $\displaystyle\int_0^\infty e^{-x^2}\, dx$.

   (e) Find an antiderivative of $\dfrac{\sqrt{kt^3 + 1}}{t}$, where k is a constant.

   (f) If $f(x) = \sqrt{\tan^3(x) - 2x}$ and $g(\alpha) = 4 + \left[\ln(\alpha) - \dfrac{1}{2}\right]^{\frac{5}{3}}$, find a decimal approximation of $f(g(\alpha))$ at $\alpha = 12$.

   (g) Plot the graph of $y = e^{-x} x^{-1}$ on the intervals $-3 \le x \le 3$ and $-10 \le y \le 10$.

2. The following fragment of a Maple worksheet is intended to add together twice the squares of even numbers and three times the cubes of odd numbers between 1 and N. It makes use of the Maple `mod` function, which is similar to the `%` operator in C, calculating the remainder in integer division (you can — and should — use the command `?mod` in Maple to learn more). Debug the code. Pay particular attention to cases where C syntax is used instead of Maple syntax.

```
> int i, N, mySum;
> N = 42;
> for i from 1 to N
  {
      if ((i mod 2) != 1) then
          mySum := mySum + 2i^2:
      fi;
      else
          mysum += 3*i^3:
      fi;
  }
> printf(mySum);
```

3. Consider the following Maple procedure:

```
> mystery := proc(a::integer, b::integer)
      local i, d, bigger, smaller;
      if ((a <= 0) or (b <= 0)) then
          RETURN("Both arguments must be positive");
      fi;
      if (a >= b) then
          bigger := a;
          smaller := b;
      else
          bigger := b;
          smaller := a;
      fi;
      for i from 1 to smaller do
          if (((smaller mod i) = 0) and ((bigger mod i) = 0)) then
              d := i;
          fi;
      od;
      RETURN(d);
   end;
```

(a) Determine the output of each of the following calls to the mystery procedure.

   (i) > mystery(4, 8);
   (ii) > mystery(8, 4);
   (iii) > mystery(13, 2);
   (iv) > mystery(6, 4);
   (v) > mystery(-6, -4);
   (vi) > mystery(5, 5);
   (vii) > mystery(0, 5);
   (viii) > mystery(1, 7);

(b) Deduce the purpose of the mystery procedure.