This exam is intended to give you an idea of the length and difficulty of the real thing. Please remember that topics not covered here could definitely still appear on the exam on Friday. You should still do lots of other practice problems.

You will have 50 minutes for the exam and are not allowed to use books, notes or calculators. Each question is worth 10 points.

1. (a) State the product rule for finding the derivative of a product \( f(x)g(x) \) of two functions \( f \) and \( g \).

   (b) Use the product rule to show that the derivative of \( f(x) = x^{\frac{3}{2}} \) is given by

   \[ f'(x) = \frac{3\sqrt{x}}{2}. \]

   (In your answer, you may only use the power rule to differentiate \( x^n \) where \( n \) is a positive integer.)

2. Find the derivative of the following function

   \[ P(t) = t^2 \cos \left( \frac{2t + 1}{2t - 1} \right). \]

3. The height \( h \) (measured in meters) of a toy rocket at a time \( t \) seconds after taking off satisfies the equation

   \[ \frac{h^2}{t^2} + 5h = 100 - 50t. \]

   How fast is the rocket moving 1 second after take off?

4. Find the equation of the tangent line to the function

   \[ H(r) = \sin(2r + \pi) \]

   at the point \( r = 0 \).

5. A television camera watching the launch of the Space Shuttle is 500 meters from the launch site. If the take-off speed of the shuttle is 100 meters per second, how fast does the camera initially need to turn (in radians per second) to keep the Shuttle in the center of the picture?