Answer the problems on **separate** paper. You do not need to rewrite the problem statements on your answer sheets. Do your own work. **Show all relevant steps** which lead to your solutions. Attach this question sheet to the front of your answer sheets.

Omit one of the problems (1, 2, 3, 4, 5, 7, 8, 9, 10).

1. (8pts) Let $f(x)=\begin{cases} ax+3 & x<2 \\ x-4 & 2\le x<5 \\ x^2-bx & 5\le x \end{cases}$. Determine *a* and *b* so that f is continuous for all values of *x*.

2. (8pts) Algebraically simplify and evaluate $5\log_2 16-6\log_3 9$.

3. (8pts) Algebraically solve $2^{x^2-2x}=8$.

4. (8pts) Algebraically solve $\log_6 x+\log_6(x+1)=1$.

5. (8pts) Using the definition, find the derivative of $f(x)=x^2-4x$.

6. (36pts) Using the rules of differentiation, find the derivative of each of the following functions. Simply the results. Write the final form of each of the derivatives using positive exponents only.

   a. $f(x)=4\sqrt{x}-\dfrac{3}{x^4}$ b. $g(x)=\dfrac{2x^5-4x^3-7x^2+1}{x^4}$

   c. $h(x)=\dfrac{2x^2-3x}{x^2+2x+4}$ d. $k(x)=e^x(\sin x-\cos x)$

7. (8pts) Let $f(x)=x^2e^x$. Find (and simplify) $f''(x)$.

8. (8pts) Let $f(x)=\sqrt[3]{x+2}$. Find the equation of the tangent line to the graph of $y=f(x)$ at $x=6$.

9. (8pts) Let $s(t)=3t^2-12t+5,\quad 1\le t\le 4,$ describe the position of a moving body. Find:

   a. the velocity $v(t)$ b. the acceleration $a(t)$ c. the total distance the body travels.

10. (8pts) A person standing at the top of a tower throws a rock straight up. It is observed that 2.4 seconds after the person releases the rock that it passes the person on its downward flight. 2.2 seconds later it strikes the ground at the base of the tower. Find:

    a. What was the initial velocity of the rock?

    b. What was the initial height of the rock when it was released from the person's hand?

    c. What was the maximum height which the rock reached during its flight?

    d. What was the velocity of the rock when it struck the ground?