Math 8 Practice Exam Problems

Disclaimer: This set of problems is meant neither to indicate the length nor composition of the actual exam. These are merely problems which were considered for inclusion on your exam, but for one reason or another were rejected. On the other hand, they should provide some flavor of the type of problems we considered.

1. Evaluate the integral $\int (\sin x + x)^2\, dx$.
2. Find the general solution to the differential equation $(D-3)^4(D^2+4D+5)^2 y = 0$.
3. Consider the homogeneous differential equation $\frac{d^2y}{dt^2} + 9y = 0$. Find the general solution as well as the particular solution which satisfies the initial conditions $y(0) = 3$ and $y'(0) = 6$.
4. Find the general solution to the differential equation $\frac{dy}{dx} = \frac{\ln x + 1}{y}$, which passes through the point $(1, 2\sqrt{2})$.
5. Consider the differential equation $\frac{d^2y}{dx^2} + b\frac{dy}{dx} + cy = 0$, where b and c are constants and $b = 2\sqrt{c}$. Determine the general solution of this differential equation.
6. Find the volume of the solid of revolution obtained by revolving the region bounded by the curves $y = e^x$, $y = 0$, $x = 0$, and $x = 1$ about the line $x = 3$.
7. The rate at which students forget formulas is proportional to the number of formulas ($\frac{dF}{dt} = kF$) If 10 minutes after walking into an exam, the student remembers only a third of the formulas initially stored in short-term memory, what fraction of the formulas are remembered 30 minutes into the exam.
8. Derive a reduction formula for $\int \sin^n x\, dx$ for $n \geq 2$. That is derive an expression for $\int \sin^n x\, dx$ in terms of $\int \sin^m x\, dx$ for $m < n$.