Summary Method C3 (Jan '06)

1.
a)
Use the formula book tables, and if necessary apply chain rule to correctly deal with the $3x$.
b)
Use the quotient rule (in the formula book), and fully simplify your answer.

2.
Use the formula for Simpson's rule from the formula book, making sure you lay out your work clearly enough to correctly identify odd ordinates, even ordinates and the ends.

3.
a)
i.
Differentiate the expression.
ii.
Notice the connection between this question and part i. Recall the rule involving logs when the top of a fraction is the derivative of the bottom.
b)
i.
Differentiate the substitution equation to find a relationship between dx and du. Replace $2x + 1$ with u, and rearrange the substitution equation in order to replace x with a function of u. Simplify.
ii.
Integrate your new integral (in terms of u), making sure you change the limits using the substitution equation before substituting in. Otherwise, change back to an expression in terms of x before substituting the original limits.

4.
a)
Use the appropriate variation of the formula $\sin^2 x + \cos^2 x = 1$ to replace $\text{cosec}^2 x$ with a function of $\cot^2 x$.
b)
Solve the quadratic, finding two solutions for $\cot x$, rearrange to give two solutions for $\tan x$.
c)
Apply your solutions individually to the graph of $\tan x$, identifying all solutions within the range for each one.

5.
a)
a is the point where the curve crosses the y-axis; in other words, where $x = 0$, so substitute this into the equation (taking care to recall that $p^0 = 1$ for any p). To find b, substitute $y = 0$ into the equation, rearrange and solve by taking logs of both sides.
b)
Square the original function, multiply out and simplify.
c)
Use $V = \int \pi y^2 dx$ to find the volume of revolution (using the expression for y^2 calculated in part b). Note that your limits will be the y-axis ($x = 0$) and the point b which was calculated in part a).
d)

Recall that the modulus function returns the same values when the outcome is positive, but changes the sign when the outcome would be negative, thus reflecting any of the curve which is currently below the x-axis to above it.

6.
a)
Substitute the values into the expression and show that one gives a result above 0, one below 0. This will indicate that the value which provides an answer of exactly 0 must lie in between.
b)
Rearrange the equation.
c)
i.
Substitute the value for x_1 into the iteration to find x_2, then x_2 to find x_3.
ii.
Draw a vertical line up from x_1 up to the curve, then horizontally across to the line $y = x$. The x coordinate at this point is x_2, so draw a vertical from here to the curve, and repeat as necessary.

7.
a)
Recall the graph of $\sin x$, and note that $\sin^{-1} x$ is only defined as a function where it is not one-to-many. Make sure your x and y coordinates are the right way round.
b)
Recall graph transformations, and note that transformations applied to the x direction work the opposite way to the y direction (ie $f(x-3)$ translates 3 to the right, and $f\left(\frac{x}{3}\right)$ stretches by scale factor 3 in the x direction.

8.
a)
The range is all the possible output values of the function. Given the domain (provided in the question), consider the possible outputs.
b)
i.
$fg(x) = f(g(x))$ so you need to substitute $g(x)$ into $f(x)$.
ii.
Put your expression from b)i. equal to 4, and rearrange. Solve the resulting quadratic, giving both solutions.
c)
i.
Recall that stationary points are where the gradient is 0, so use the expression for $\frac{dy}{dx}$ from part a), and solve to find x. Make sure you leave your answer in terms of e.
ii.
Substitute the limits of 1 and 5 into your answer for part b), and simplify. Make sure you clearly demonstrate how your answer simplifies to the required form.