

Answer each question to the best of your ability. Show all work clearly and in order, and circle your final answers. Final answers MUST be supported in order to receive credit. Good luck!

1.  $\int \sin x \cos(\cos x) dx = \int -\cos u du$

Let  $u = \cos x$   
 $du = -\sin x dx$

$$= -\sin u + C$$
$$= \boxed{-\sin(\cos x) + C}$$

2.  $\int \frac{\sqrt{x} - 2x}{x} dx = \int \frac{\sqrt{x}}{x} - \frac{2x}{x} dx$

$$= \int x^{1/2} - 2 dx$$
$$= \int x^{-1/2} - 2 dx$$

→  $\boxed{2x^{1/2} - 2x + C}$

3.  $\int \sec x(\tan x - \cos x) dx$

$$= \int \sec x \tan x - \underbrace{\sec x \cos x}_{=1} dx$$
$$= \boxed{\sec x - x + C}$$

4.  $\int \frac{e^x}{e^x + 1} dx \rightarrow = \int \frac{1}{u} du = \ln|u| + C$

Let  $u = e^x + 1$   
Then  $du = e^x dx$

$$= \boxed{\ln|e^x + 1| + C}$$

5.  $\int \frac{x}{1-x} dx = -\int \frac{1-u}{u} du$

Let  $u = 1-x$   
 $du = -dx$   
 $x = 1-u$

$$= -\int \frac{1}{u} - \frac{u}{u} du$$
$$= -\ln|u| + u + C$$
$$= \boxed{-\ln|1-x| + (1-x) + C}$$

6.  $\int_0^1 x^2(1+2x^3)^3 dx$

Let  $u = 1+2x^3$   
 $du = 6x^2 dx$   
 $dx = \frac{du}{6x^2}$

$x=0 \Rightarrow u=1$   
 $x=1 \Rightarrow u=3$

$\int_1^3 \frac{1}{6} u^3 du$   
 $= \frac{1}{24} u^4 \Big|_1^3 = \frac{1}{24} (3^4 - 1^4)$   
 $= \frac{1}{24} (81 - 1)$   
 $= \frac{80}{24} = \frac{10}{3}$

7.  $\int_e^{e^4} \frac{dx}{x\sqrt{\ln x}}$

Let  $u = \ln x$   
 $du = \frac{1}{x} dx$   
 $x=e \Rightarrow u=1$   
 $x=e^4 \Rightarrow u=4$

$\int_1^4 \frac{du}{\sqrt{u}} = \int_1^4 u^{-1/2} du = 2u^{1/2} \Big|_1^4$   
 $= 2(4^{1/2} - 1^{1/2})$   
 $= 2(2-1) = 2$

8.  $\int_1^4 \frac{x^3 - 2x^2 + \sqrt{x}}{x} dx$

$= \int_1^4 \frac{x^3}{x} - \frac{2x^2}{x} + \frac{x^{1/2}}{x} dx$   
 $= \int_1^4 x^2 - 2x + x^{-1/2} dx$

$\frac{1}{3}x^3 - x^2 + 2x^{1/2} \Big|_1^4$   
 $= (\frac{64}{3} - 16 + 4) - (\frac{1}{3} - 1 + 2)$   
 $= \frac{64}{3} - 15 + 2 = 21 - 15 + 2 = 8$

9.  $\int_4^9 2x\sqrt{x} dx$

$= \int_4^9 2x \cdot x^{1/2} dx = \int_4^9 2x^{3/2} dx = \frac{4}{5} x^{5/2} \Big|_4^9$   
 $= \frac{4}{5} (9^{5/2} - 4^{5/2})$   
 $= \frac{4}{5} (3^5 - 2^5) = \frac{4}{5} (243 - 32) = \frac{844}{5}$

10.  $\int_0^1 xe^{-x^2} dx$

Let  $u = -x^2$   
 $du = -2x dx$   
 $dx = \frac{du}{-2x}$

$x=0 \Rightarrow u=0$   
 $x=1 \Rightarrow u=-1$

$\int_0^{-1} -\frac{1}{2} e^u du = -\frac{1}{2} \int_0^{-1} e^u du$   
 $= -\frac{1}{2} e^u \Big|_0^{-1}$   
 $= -\frac{1}{2} (e^{-1} - e^0)$   
 $= -\frac{1}{2} (\frac{1}{e} - 1)$

$-\frac{1}{2e} + \frac{1}{2}$