

Here are some good review questions. The actual exam might be of a different format, but these will help you understand the concepts covered on the exam. Try to do as many of these as you can without looking in your notes or book for guidance.

1. Calculate the following integrals:

(a) $\int \frac{x-2}{x^2-4x} dx$

(b) $\int x \sin(x^2) dx$

(c) $\int x \sin x dx$

(d) $\int x \cos x dx$

(e) $\int e^{2x} \sin x dx$

(f) $\int_1^9 \sqrt{x} \ln x dx$

(g) $\int \frac{4x^2-7}{2x+3} dx$

(h) $\int \cos^3 \theta d\theta$

(i) $\int (\csc x - \tan x)^2 dx$

(j) $\int \sqrt{1-\cos^2 \theta} d\theta$

(k) $\int (\csc x - \sec x)(\sin x + \cos x) dx$

(l) $\int 2x \sin^{-1}(x^2) dx$

(m) $\int x \sin^{-1}(x) dx$

(n) $\int (r^2 + r + 1)e^r dr$

(o) $\int \frac{1}{\sqrt{x+1}} dx$

(p) $\int \frac{6x^3 + 9x + 5}{x^4 + 3x^2 - 4} dx$

(q) $\int \frac{1}{e^{3x} - e^x} dx$ (This one is a little tricky)

(r) $\int \frac{x^2}{x^3 + 7} dx$

(s) $\int_{-1}^2 x^2 e^{x^3} dx$

(t) $\int \sin 3x \cos 5x dx$ (Hint: This requires one of those weird trig. formulas)

(u) $\int \tan^3 x \sec^3 x dx$

(v) $\int \sin^3 x \cos x dx$

(w) $\int \tan^4 x \sec^2 x dx$

2. Calculate these integrals, too:

(a) $\int x^3 \sqrt{x^2 + 2} dx$ (This one is a little tricky)

(b) $\int \frac{2x}{(x+1)(2x-2)} dx$

(c)
$$\int \frac{x^3 - 2x^2 + 3x}{x^2 - 1} dx$$

(d)
$$\int \frac{1}{x^3 + x} dx$$

3. Solve the following differential equations:

(a)
$$x \frac{dy}{dx} = \frac{\cos x}{x} - 2y, x > 0$$

(b)
$$e^x \frac{dy}{dx} + 2e^x y = 1$$

(c)
$$\frac{dy}{dt} + 2y = 3, y(0) = 1$$

(d)
$$\theta \frac{dy}{d\theta} + y = \sin \theta, \theta > 0, y\left(\frac{\pi}{2}\right) = 1$$

4. Calculate the following integrals:

(a)
$$\int \frac{dy}{y^2 - 2y + 2}$$

(b)
$$\int \ln \sqrt{x-1} dx$$

(c)
$$\int \frac{x+1}{x^2(x^2+1)} dx$$

(d)
$$\int x^3 e^{x^2} dx$$

(e)
$$\int \sin^2 x dx$$

(f)
$$\int \frac{e^t dt}{1 + e^t}$$

(g)
$$\int \frac{\cot v dv}{\ln(\sin v)}$$

(h)
$$\int e^x \cos(2x) dx$$

(i)
$$\int \frac{dx}{(x^2 - 1)^{\frac{3}{2}}}$$

5. Determine if the following integrals converge or diverge. Give reasons for your answers. If the integral converges, find its value if possible.

(a)
$$\int_0^1 \ln x dx$$

(b)
$$\int_3^5 \frac{1}{x-4} dx$$

(c)
$$\int_0^3 \frac{dx}{\sqrt{9-x^2}}$$

(d)
$$\int_0^\infty \frac{2dx}{x^2 - 2x}$$

(e)
$$\int_1^\infty \frac{3x-1}{4x^3 - x^2}$$

(f)
$$\int_0^\infty x^2 e^{-x} dx$$

(g)
$$\int_1^\infty \frac{e^{-t}}{\sqrt{t}} dt$$