1. (2 pts) In this case we'll need to split the integral up do different substitutions on each one.

$$\int \sec^2(6x)+(1-x)^3\,dx = \int \sec^2(6x)\,dx + \int (1-x)^3\,dx$$

$$u=6x \quad du=6dx \quad dx=\tfrac{1}{6}du \qquad\qquad v=1-x \quad dv=-dx \quad dx=-dv$$

$$\int \sec^2(6x)+(1-x)^3\,dx = \tfrac{1}{6}\int \sec^2(u)\,du - \int v^3\,dv$$

$$= \tfrac{1}{6}\tan(u) - \tfrac{1}{4}v^4 + c = \boxed{\tfrac{1}{6}\tan(6x) - \tfrac{1}{4}(1-x)^4 + c}$$

2. (2 pts) We'll first need to split this up and then use different substitutions on each one.

$$\int \frac{2-7z}{1+16z^2}\,dz = \int \frac{2}{1+16z^2}\,dz - \int \frac{7z}{1+16z^2}\,dz = \int \frac{2}{1+(4z)^2}\,dz - \int \frac{7z}{1+16z^2}\,dz$$

$$u=4z \quad du=4dz \quad dz=\tfrac{1}{4}du \qquad\qquad v=1+16z^2 \quad dv=32z\,dz \quad z\,dz=\tfrac{1}{32}dv$$

$$\int \frac{2-7z}{1+16z^2}\,dz = \frac{2}{4}\int \frac{1}{1+u^2}\,du - \frac{7}{32}\int \frac{1}{v}\,dv = \frac{1}{2}\tan^{-1}(u) - \frac{7}{32}\ln|v| + c$$

$$= \boxed{\frac{1}{2}\tan^{-1}(4z) - \frac{7}{32}\ln\left|1+16z^2\right| + c}$$

9. (2 pts) $\int_3^{-1} 12x^5 - 8x^3 + 1\,dx = \left(2x^6 - 2x^4 + x\right)\Big|_3^{-1} = -1 - 1299 = \boxed{-1300}$

11. (2 pts) Because the "cut-off" point is in the middle of the interval of integration we'll need to split the integral up at the "cut-off" point and integrate each separately.

$$\int_{-3}^{0} f(t)\,dt = \int_{-3}^{-2} f(t)\,dt + \int_{-2}^{0} f(t)\,dt = \int_{-3}^{-2} 1-t^2\,dt + \int_{-2}^{0} \mathbf{e}^t\,dt$$

$$= \left(t - \tfrac{1}{3}t^3\right)\Big|_{-3}^{-2} + \mathbf{e}^t\Big|_{-2}^{0} = \tfrac{2}{3} - (6) + 1 - \mathbf{e}^{-2} = \boxed{-\tfrac{13}{3} - \mathbf{e}^{-2} = -4.4686686}$$

12. (2 pts) We first need to get rid of the absolute value bars. It's easy to see that the quantity in the absolute value bars will be zero at $w=3$ and that we'll have $6-2w>0$ if $w<3$ and $6-2w<0$ if $w>3$. So,

$$\int_1^4 |6-2w|\,dw = \int_1^3 |6-2w|\,dw + \int_3^4 |6-2w|\,dw = \int_1^3 6-2w\,dw - \int_3^4 6-2w\,dw$$

$$= \left(6w - w^2\right)\Big|_1^3 - \left(6w - w^2\right)\Big|_3^4 = (9-5) - (8-9) = \boxed{5}$$

Not Graded

3. $u = \ln(t) \qquad du = \dfrac{1}{t}dt$

$$\int \frac{\cos(\ln(t))-2}{t}\,dt = \int \cos(u)-2\,du = \sin(u)-2u+c = \boxed{\sin(\ln(t))-2\ln(t)+c}$$

4. This is one of those "tricky" substitution in the sense that you need to use it twice as follows.

$$u = 2+y^4 \qquad du = 4y^3\,dy \qquad y^3 dy = \tfrac{1}{4}du \qquad y^4 = u-2$$

$$\int \frac{y^7}{2+y^4}\,dy = \int \frac{y^4 y^3}{2+y^4}\,dy = \frac{1}{4}\int \frac{u-2}{u}\,du = \frac{1}{4}\int 1-\frac{2}{u}\,du = \frac{1}{4}\left(u-2\ln|u|\right)+c$$

$$= \boxed{\frac{1}{4}\left(2+y^4-2\ln\left|2+y^4\right|\right)+c}$$

5. For this problem we have $\Delta x = \frac{1}{2}$ and the subintervals are [1, 1.5], [1.5, 2], [2, 2.5],[2.5, 3]. So, using the midpoints of each of these we get,

$$\text{Area} \approx \tfrac{1}{2}\left[g(1.25)+g(1.75)+g(2.25)+g(2.75)\right] = -10.17180965$$

For reference purposes the exact area is -10.40305447 (you don't need to worry about computing this, although if you take Calc II you should be able to compute it at that point).

6.

$$\int_{-3}^{10} 3g(x)-12f(x)\,dx = \int_{-3}^{10} 3g(x)\,dx - \int_{-3}^{10} 12f(x)\,dx = 3\int_{-3}^{10} g(x)\,dx - 12\int_{-3}^{10} f(x)\,dx$$

$$= 3\int_{-3}^{10} g(x)\,dx - 12\left(-\int_{10}^{-3} f(x)\,dx\right) = 3(9)+12(5) = \boxed{97}$$

7.

$$\int_{-4}^{12} f(x)\,dx = \int_{-4}^{20} f(x)\,dx + \int_{20}^{8} f(x)\,dx + \int_{8}^{12} f(x)\,dx$$

$$= \int_{-4}^{20} f(x)\,dx + \int_{20}^{8} f(x)\,dx - \int_{12}^{8} f(x)\,dx = 8+(-3)-(1) = \boxed{4}$$

8. $\int_{x^2}^{4} \ln\left(1+\mathbf{e}^{9t}\right)dt = -\int_{4}^{x^2} \ln\left(1+\mathbf{e}^{9t}\right)dt = \boxed{-2x\ln\left(1+\mathbf{e}^{9x^2}\right)}$

10. $\int_{0}^{\frac{\pi}{4}} \cos(\alpha)-3\sin(\alpha)\,d\alpha = \left(\sin(\alpha)+3\cos(\alpha)\right)\Big|_0^{\frac{\pi}{4}} = \frac{\sqrt{2}}{2}+\frac{3\sqrt{2}}{2}-(0+3) = \boxed{2\sqrt{2}-3}$

13.

$$\int_2^3 5x^3+8x^{-3}-\frac{1}{4}\frac{1}{x}\,dx = \left(\tfrac{5}{4}x^4-4x^{-2}-\tfrac{1}{4}\ln|x|\right)\Big|_2^3 = \tfrac{3629}{36}-\tfrac{1}{4}\ln(3)-\left(19-\tfrac{1}{4}\ln(2)\right)$$

$$= \boxed{\tfrac{2945}{36}+\tfrac{1}{4}\ln(3)-\tfrac{1}{4}\ln(2) = 81.7042}$$

14. Now, before we jump right into this problem notice that we have division by zero issues in the second and third terms at $x = 0$ and because $x = 0$ is inside our interval of integration for this problem (as opposed to **#13** where it isn't in the interval) we **can't do this integral**. Note that the fact that we can integrate the first term is not relevant. We can't do the integral because of the problems in the second and third terms.