Pencil and Paper homework Number 11a

This homework concerns Elementary Integration.

1) Find the following primary integrals

a) $\int x^3 + 4x^2 - 3x + 9\,dx$

b) $\int e^{-3x}\,dx$

c) $\int e^{5x}\,dx$

d) $\int \sin 5x\,dx$

e) $\int \cos 3x\,dx$

f) $\int \sec^2 3x\,dx$

g) $\int \sec 2x \tan 2x\,dx$

h) $\int \sinh 4x\,dx$

i) $\int \sqrt{3x}\,dx$

j) $\int x^{\frac{4}{3}} + x^{\frac{3}{4}}\,dx$

2) Find the following integrals by using easy algebraic transformations

a) $\int \frac{2x^3+3x^2-4x-5}{x^2}\,dx$

b) $\int \frac{3\cos^3 x - 5\cos^2 x + 4}{\cos^2 x}\,dx$

c) $\int \frac{3e^{4x}-e^{2x}+e^x}{e^{2x}}\,dx$

d) $\int \frac{x^4+x^2+2}{x^2+1}\,dx$

3) Find the following integrals by using easy substitutions.

a) $\int e^{\sin x}\cos x\,dx$

b) $\int x(x^2+3)^4\,dx$

c) $\int x\sin(x^2)\,dx$

d) $\int (2x+3)\sin(x^2+3x+5)\,dx$

e) $\int (2x-3)\sqrt{x^2-3x+9}\,dx$

f) $\int x^2(x^3-8)^{\frac{4}{3}}\,dx$

g) $\int \frac{x}{\sqrt{x^2-8}}\,dx$

h) $\int \frac{x}{(x^2-8)^{\frac{4}{3}}}\,dx$

i) $\int \sin 2t \cos 2t\,dx$

j) $\int \tan 3t \sec^2 3t\,dt$

4) Find the following integrals by using the double angle formulas, which I give you in their most useful forms.

$$\sin\theta\cos\theta = \frac{1}{2}\sin 2\theta \qquad \sin^2\theta = \frac{1}{2}(1-\cos 2\theta) \qquad \cos^2\theta = \frac{1}{2}(1+\cos 2\theta)$$

a) $\int \sin x\ \cos x\, dx$

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

c) $\int \sin^2 4x\, dx$

d) $\int \cos^2 4x\, dx$

e) $\int \sin^2 4x\ \cos^2 4x\, dx$

5) Some easy substitutions for practise

a) $\int \sin^{10} 2x\ \cos 2x\, dx$

b) $\int x(x^2+8)^{13}\, dx$

c) $\int xe^{2x^2-8}\, dx$

d) $\int x^2\sqrt{x^3+9}\, dx$

e) $\int \frac{x^2}{\sqrt{x^3+9}}\, dx$

f) $\int \frac{x^2}{(x^3+9)^{\frac{5}{3}}}\, dx$

6) Fluffy got into the passengers meals and the exasperated cabin attendent flings the cat out of the plane. Upward. At 44 ft/sec. At the time, the plane was at 16,000 ft. Because of air resistence the downward acceleration is 28 ft/sec. Find the equation giving Fluffy's height above the ground. You need

$$\begin{aligned} \frac{dv}{dt} &= -28 \\ \frac{dh}{dt} &= v(t) \end{aligned}$$

First find $v(t)$ by using integration (and finding C) and then find $h(t)$ by using integration (and finding another C). Notice that now that you have Calculus you don't need to remember any dumb formulas for falling cats; you can derive them yourself.