QSci 292 • answers • Hmwk #3

Neu. 3rd ed., sec. 7.1, p 333
Neu. 2nd ed., sec. 7.1, p406

#5) $F = \int 5\cos(3x)\,dx$

Let: $u = 3x$
$du = 3\,dx$
$dx = \frac{1}{3}\,du$

$F = 5\int \cos(u)\left(\frac{1}{3}du\right) = \frac{5}{3}\int \cos(u)\,du$

$F = \frac{5}{3}\sin(u) + C \quad \therefore \quad \boxed{F = \frac{5}{3}\sin(3x) + C}$

#9) $F = \int e^{2x+3}\,dx$

Let: $u = 2x+3$
$du = 2\cdot dx$
$dx = \frac{1}{2}\,du$

$F = \frac{1}{2}\int e^{u}\,du = \frac{1}{2}e^{u} + C$

$\boxed{F = \frac{1}{2}e^{2x+3} + C}$

#13) $F = \int\left(\frac{x+2}{x^2+4x}\right)dx$

Let: $u = x^2+4x$
$du = (2x+4)\,dx$
$dx = \frac{1}{2}\left(\frac{1}{x+2}\right)du$

$F = \frac{1}{2}\int \frac{x+2}{u}\left(\frac{1}{x+2}\right)du = \frac{1}{2}\int \frac{1}{u}\,du$

$F = \frac{1}{2}\ln(u) + C \quad \therefore \quad \boxed{F = \frac{1}{2}\ln(x^2+4x) + C}$

<u>note</u>: other forms of the answer are:

$F = \frac{1}{2}\{\ln(x) + \ln(x+4)\} + C$

$F = \ln\left(\sqrt{x(x+4)}\right) + C$

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#16) $F = \int \frac{x}{5-x}\,dx$ Let: $u = 5-x$ $(x = 5-u)$, $du = -dx$, $dx = -du$

$F = -\int \frac{x}{u}\,du = -\int \left(\frac{5-u}{u}\right) du$

$F = -5\int \frac{1}{u}\,du + \int du = -5\ln(u) + u + C_1$

$\therefore \boxed{F = -5\ln(5-x) + (5-x) + C_1}$

or $F = \ln\left(1/(5-x)^5\right) + x + C_2$ $(C_2 = C_1 + 5)$

note: #16 (Neu 2nd) $F = \int \frac{1}{5-x}\,dx = -\int \frac{du}{u} = -\ln(u) + C$

$F = -\ln(5-x) + C$

#18) $F = \int (4-x)^{1/7}\,dx$ Let: $z = 4-x$, $dz = -dx$, $dx = -dz$

$F = -\int z^{1/7}\,dz = -\frac{7}{8} z^{8/7} + C$

$\boxed{F = -\frac{7}{8}(4-x)^{8/7} + C}$

note: #18 (Neu. 2nd) $F = \int \sqrt{4-x}\,dx = -\int \sqrt{z}\,dz = -\frac{2}{3}(4-x)^{3/2} + C$

#20) $F = \int (x^2-2x)\left(x^3-3x^2+3\right)^{2/3} dx$ Let: $z = x^3-3x^2+3$, $dz = (3x^2-6x)\,dx$, $dx = \frac{1}{3(x^2-2x)}\,dz$

$F = \frac{1}{3}\int z^{2/3}\,dz \quad \therefore \boxed{F = \frac{1}{5}\left(x^3-3x^2+3\right)^{5/3} + C}$

note: #18 (Neu. 2nd) $F = \int (x^2-2x)\sqrt{x^3-3x^2+3}\;dx$

$F = \frac{2}{9}(x^3-3x^2+3)^{3/2} + C$

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#30) $F = \int \cos(2x-1)\,dx$ Let: $w = 2x-1$, $dw = 2\cdot dx$, $dx = \frac{1}{2}\cdot dw$

$F = \frac{1}{2}\int \cos(w)\,dw \;\therefore\; \boxed{F = \frac{1}{2}\sin(2x-1)+C}$

#32) $F = \int \sin^3(x)\cdot\cos(x)\,dx$ Let: $u = \sin(x)$, $du = \cos(x)$, $dx = \frac{1}{\cos(x)}\cdot du$

$F = \int u^3\,du \;\therefore\; \boxed{F = \frac{1}{4}\sin^4(x) + C}$

#34) $F = \int \frac{1}{(x-3)\ln(x-3)}\,dx$ Let: $z = x-3$, $dz = dx$

$F = \int \frac{1}{z\cdot\ln(z)}\,dz$ Let: $u = \ln(z)$, $du = \frac{1}{z}\,dz$, $dz = z\cdot du$

$F = \int \frac{1}{u}\,du = \ln(u)+C = \ln(\ln(z))+C$

$\therefore\; \boxed{F = \ln(\ln(x-3)) + C}$

#36) $F = \int \sqrt{1+\ln(x)}\cdot\ln(x)\cdot\frac{1}{x}\cdot dx$ Let: $z = 1+\ln(x)$, $(\ln(x) = z-1)$, $dz = \frac{1}{x}\cdot dx$, $dx = x\cdot dz$

$F = \int \sqrt{z}\,(z-1)\,dz = \int z^{3/2}dz - \int z^{1/2}\,dz$

$F = \frac{2}{5}z^{5/2} - \frac{2}{3}z + C$

$$\boxed{F = \frac{2}{5}\left(1+\ln(x)\right)^{5/2} - \frac{2}{3}\left(1+\ln(x)\right)^{3/2} + C}$$

or $F = \frac{2}{5}\sqrt{(1+\ln(x))^5} - \frac{2}{3}\sqrt{(1+\ln(x))^3} + C$