HW Review p. 373: 5-8, 15, 17, 18, 26, 32, 39-42, 49, 56

Tuesday, March 3, 2015 10:55 AM

(5) $\int_0^{\frac{\pi}{2}} 5\sin^{\frac{3}{2}}x\cos x\,dx = \int_0^1 5u^{\frac{3}{2}}du = 5\left(\frac{2}{5}\right)u^{\frac{5}{2}}\Big|_0^1 = 2u^{\frac{5}{2}}\Big|_0^1$

$= 2(1)^{\frac{5}{2}} - 2(0)^{\frac{5}{2}}$

$= 2-0$

$= \boxed{2}$

$u = \sin x$ $\quad u(0)=0$

$du = \cos x\,dx$ $\quad u(\frac{\pi}{2})=1$

(6) $\int_{\frac{1}{2}}^4 \frac{x^2+3x}{x}dx = \int_{\frac{1}{2}}^4 (x+3)dx = \left(\frac{1}{2}x^2+3x\right)\Big|_{\frac{1}{2}}^4 = \left(\frac{1}{2}(4)^2+3(4)\right)-\left(\frac{1}{2}\left(\frac{1}{2}\right)^2+3\left(\frac{1}{2}\right)\right)$

Simplify first!

$= (20)-\left(\frac{1}{8}+\frac{3}{2}\right)$

$= \boxed{18\frac{3}{8} = \frac{147}{8}}$

(7) $\int_0^{\frac{\pi}{4}} e^{\tan x}\sec^2 x\,dx = \int_0^1 e^u du = e^u\Big|_0^1 = e^1 - e^0$

$= \boxed{e-1}$

$u = \tan x$ $\quad u(0)=0$

$du = \sec^2 x\,dx$ $\quad u(\frac{\pi}{4})=1$

(8) $\int_1^e \frac{\sqrt{\ln r}}{r}dr = \int_0^1 u^{\frac{1}{2}}du = \frac{2}{3}u^{\frac{3}{2}}\Big|_0^1 = \frac{2}{3}(1)^{\frac{3}{2}} - \frac{2}{3}(0)^{\frac{3}{2}} = \boxed{\frac{2}{3}}$

$u = \ln r$ $\quad u(1)=0$

$du = \frac{1}{r}dr$ $\quad u(e)=1$

(15) $\int \frac{\tan(\ln y)}{y}dy = \int \tan u\,du$

$= \int \frac{\sin u}{\cos u}du$

$= -\int \frac{1}{v}dv$

$= -\ln|v| + C$

$= -\ln|\cos u| + C$

$= \boxed{-\ln|\cos(\ln y)| + C}$

$u = \ln y$

$du = \frac{1}{y}dy$

$v = \cos u$

$dv = -\sin u\,du$

$-dv = \sin u\,du$

(17) $\int \frac{dx}{x\ln x} = \int \frac{du}{u} = \ln|u| + C$

$= \boxed{\ln|\ln x| + C}$

$u = \ln x$

$du = \frac{1}{x}dx$

(18) $\int \frac{dt}{t\sqrt{t}} = \int t^{-1}\cdot t^{-\frac{1}{2}}dt$

$= \int t^{-\frac{3}{2}}dt = -2t^{-\frac{1}{2}} + C$

$= \boxed{\frac{-2}{\sqrt{t}} + C}$

(26) $\frac{dy}{dx} = \left(x+\frac{1}{x}\right)^2$ $\quad y(1)=1$

(32) $\frac{dy}{dx} = (2x+1)(y+1)$ $\quad y(-1)=1$

(26) $\frac{dy}{dx} = (x + \frac{1}{x})$ $\quad y(1) = 1$

$$\frac{dy}{dx} = (x+\tfrac{1}{x})(x+\tfrac{1}{x})$$
$$\frac{dy}{dx} = x^2 + 2 + \frac{1}{x^2}$$
$$y = \frac{1}{3}x^3 + 2x - \frac{1}{x} + C$$
$$1 = \frac{1}{3}(1)^3 + 2(1) - \frac{1}{1} + C$$
$$-\frac{1}{3} = C$$
$$\boxed{y = \frac{1}{3}x^3 + 2x - \frac{1}{x} - \frac{1}{3}}$$

(32) $\frac{dy}{dx} = (2x+1)(y+1)$ $\quad y(-1) = 1$

$$\int \frac{1}{y+1}\,dy = \int (2x+1)\,dx$$
$$\ln|y+1| = x^2 + x + C$$
$$\ln|2| = (-1)^2 + (-1) + C$$
$$\ln 2 = C$$
$$\ln|y+1| = x^2 + x + \ln 2$$
$$|y+1| = e^{x^2+x+\ln 2} = 2e^{x^2+x}$$
$$\boxed{y = 2e^{x^2+x} - 1}$$

(39) b vertical when $x = -y$

(40) d vertical when $x = y$

(41) c

(42) a

(49) acceleration is $\frac{d^2s}{dt^2} = 2 + 6t$ m/s^2

at $t = 0$ $v = 4$ m/s

$v(0) = s'(0) = 4$

(a) Find $v(t) = \frac{ds}{dt} = 2t + 3t^2 + C$
$$4 = 2(0) + 3(0)^2 + C$$
$$4 = C$$
$$\boxed{v(t) = 2t + 3t^2 + 4}$$

(b)
$$s(1) = \int_0^1 v(t)\,dt = (t^2 + t^3 + 4t)\Big|_0^1 = (1^2 + 1^3 + 4(1)) - (0^2 + 0^3 + 4(0))$$
$$= \boxed{6\,\text{m}}$$

(56) 1924: \$250

1988: \$7500

$t = 64$ yrs
$$7500 = 250e^{k(64)}$$
$$30 = e^{64k}$$
$$\boxed{k = .053 \approx 5.3\%}$$

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