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

(ب) تحقق: $\frac{d}{dx}\left(\frac{x^3}{3} - x^2 + x + C\right) = x^2 - 2x + 1$

(2) (أ) $\int (\ x^2 - 4\sqrt{x}\ )dx = \int (\ x^2 - 4x^{1/2}\ )dx = \frac{x^3}{3} - \frac{8}{3}x^{3/2} + C$

(ب) تحقق: $\frac{d}{dx}\left(\ \frac{x^3}{3} - \frac{8}{3}x^{3/2} + C\ \right) = x^2 - 4x^{1/2} = x^2 - 4\sqrt{x}$

(3) $\int (x^5 - 6x + 3)dx = \frac{x^6}{6} - 3x^2 + 3x + C$

(4) $\int \left(x^3 - \frac{1}{x^3}\right)dx = \int (x^3 - x^{-3})dx = \frac{x^4}{4} + \frac{x^{-2}}{2} + C = \frac{x^4}{4} + \frac{1}{2x^2} + C$

(5) $\int \frac{1}{3}x^{-2/3}\,dx = x^{1/3} + C$

(6) $\int \frac{\pi}{2}\cos\left(\frac{\pi}{2}x\right) dx = \sin\left(\frac{\pi}{2}x\right) + C$

(7) $\int 5\sec^2 5r\ dr = \tan 5r + C$

(8) $\int \cos^2 x\ dx = \int \frac{1 + \cos 2x}{2}dx = \int \left(\frac{1}{2} + \frac{\cos 2x}{2}\right)dx = \frac{x}{2} + \frac{\sin 2x}{4} + C$

(9) $\int \tan^2\theta\ d\theta = \int (\sec^2\theta - 1)d\theta = \tan\theta - \theta + C$

(10) $\int \sin^2 x\ dx = \int \frac{1 - \cos 2x}{2}dx = \int \left(\frac{1}{2} - \frac{\cos 2x}{2}\right)dx = \frac{x}{2} - \frac{\sin 2x}{4} + C$

(11) (أ) الرسم البياني (b) $y = \frac{-x^2}{2} + \frac{3}{2}$

(ب) حل المعادلة هو دالة تربيعية فيها معامل x^2 سالب لذا يمكن حذف كل من (a) و (c) وبالتالي الإجابة هي b

(12) $\frac{dy}{dx} = 2x - 1$

$$\int \frac{dy}{dx}\,dx = \int (2x - 1)dx$$

$$y = x^2 - x + C$$

فرضية أساسية: $y(2) = 0$

$$0 = 2^2 - 2 + C$$

$$0 = 2 + C$$

$$-2 = C$$

الحل: $y = x^2 - x - 2$

(13) $$\frac{dy}{dx} = \sec^2 x$$

$$\int \frac{dy}{dx}\,dx = \int \sec^2 x\,dx$$

$$y = \tan x + C$$

فرضية أساسية: $y\left(\frac{\pi}{4}\right) = -1$

$$-1 = \tan\frac{\pi}{4} + C$$

$$-1 = 1 + C$$

$$-2 = C$$

الحل: $y = \tan x - 2$

(14) $$\frac{dy}{dx} = 9x^2 - 4x + 5$$

$$\int \frac{dy}{dx}dx = \int (9x^2 - 4x + 5)dx$$

$$y = 3x^3 - 2x^2 + 5x + C$$

فرضية أساسية: $y(-1) = 0$

$$0 = 3(-1)^3 - 2(-1)^2 + 5(-1) + C$$

$$0 = -10 + C$$

$$10 = C$$

الحل: $y = 3x^3 - 2x^2 + 5x + 10$

(15) $$\frac{dy}{dx} = \cos x + \sin x$$

$$\int \frac{dy}{dx}\,dx = \int (\cos x + \sin x)dx$$

$$y = \sin x - \cos x + C$$

فرضية أساسية: $y(\pi) = 1$

$$1 = \sin\pi - \cos\pi + C$$

$$1 = 1 + C$$

$$0 = C$$

الحل: $y = \sin x - \cos x$

$$\frac{d^2y}{dx^2}dx = 2 - 6x \qquad \textbf{(16)}$$

$$\int \frac{d^2y}{dx^2}dx = \int (2 - 6x)dx$$

$$\frac{dy}{dx} = 2x - 3x^2 + C_1$$

فرضية أساسية: $y'(0) = 4$

$$4 = 2(0) - 3(0)^2 + C_1$$

$$4 = C_1$$

المشتقة الأولى: $\frac{dy}{dx} = 2x - 3x^2 + 4$

$$\int \frac{dy}{dx}dx = \int \left(2x - 3x^2 + 4\right)dx$$

$$y = x^2 - x^3 + 4x + C_2$$

فرضية أساسية: $y(0) = 1$

$$1 = 0^2 - 0^3 + 4(0) + C_2$$

$$1 = C_2$$

الحل: $y = x^2 - x^3 + 4x + 1$ أو $y = -x^3 + x^2 + 4x + 1$

$$\frac{ds}{dt} = v = 9.8t + 5 \qquad \textbf{(17)}$$

$$\int \frac{ds}{dt}dt = \int (9.8t + 5)dt$$

$$s = 4.9t^2 + 5t + C$$

فرضية أساسية: $s(0) = 10$

$$10 = 4.9(0)^2 + 5(0) + C$$

$$10 = C$$

الحل: $s = 4.9t^2 + 5t + 10$

$$\frac{ds}{dt} = v = \sin \pi t \qquad \textbf{(18)}$$

$$\int \frac{ds}{dt}\,dt = \int \sin \pi t\,dt$$

$$s = -\frac{1}{\pi}\cos \pi t + C$$

فرضية أساسية: $s(1) = 0$

$$0 = -\frac{1}{\pi}\cos \pi + C$$

$$0 = \frac{1}{\pi} + C$$

$$-\frac{1}{\pi} = C$$

$s = -\frac{1}{\pi}(1 + \cos \pi t)$ أو $s = -\frac{1}{\pi}\cos \pi t - \frac{1}{\pi}$

(19) $$\frac{dv}{dt} = a = \cos t$$

$$\int \frac{dv}{dt} dt = \int \cos t \, dt$$

$$v = \sin t + C_1$$

فرضية أساسية: $v(0) = -1$

$$-1 = \sin 0 + C_1$$

$$-1 = C_1$$

السرعة اللحظية: $\frac{ds}{dt} = v = \sin t - 1$

$$\int \frac{ds}{dt} dt = \int (\sin t - 1) \, dt$$

$$s = -\cos t - t + C_2$$

فرضية أساسية: $s(0) = 1$

$$1 = -\cos 0 - 0 + C_2$$

$$1 = -1 + C_2$$

$$2 = C_2$$

الحل: $s = -\cos t - t + 2$

(20) $$\int \frac{dr}{dx} dx = \int (3x^2 - 6x + 12) dx$$

$$r = x^3 - 3x^2 + 12x + C$$

فرضية أساسية: $r(0) = 0$

$$0 = 0^3 - 3(0)^2 + 12(0) + C$$

$$0 = C$$

الحل: $r(x) = x^3 - 3x^2 + 12x$

(21) **(a)** $\int f(x) dx = \int \frac{d}{dx}(x^2) \, dx = x^2 + C$

(b) $\int [-f(x) \, dx] = -\int f(x) \, dx = -x^2 + C$

(c) $\int [f(x) + g(x)] \, dx = \int f(x) \, dx + \int g(x) \, dx = x^2 + x \sin x + C$

(d) $\int [x + f(x)] \, dx = \int x \, dx + \int f(x) \, dx = \frac{x^2}{2} + x^2 + C$

(22) (أ) $\int \frac{d^2 s}{dt^2}\, dt = \int -k\, dt$

$$\frac{ds}{dt} = -kt + C_1$$

فرضية أساسية: $\frac{ds}{dt} = 88$ عندما $t = 0$

$$88 = (-k)(0) + C_1$$
$$88 = C_1$$

السرعة اللحظية: $\frac{ds}{dt} = -kt + 88$

$$\int \frac{ds}{dt}\, dt = \int (-kt + 88)\, dt$$
$$s = -\frac{k}{2} t^2 + 88t + C_2$$

فرضية أساسية: $s = 0$ عندما $t = 0$

$$0 = -\frac{k}{2}(0)^2 + 88(0) + C_2$$
$$0 = C_2$$

الحل: $s = -\frac{kt^2}{2} + 88t$

(ب) $\frac{ds}{dt} = 0$

$$-kt + 88 = 0$$
$$t = \frac{88}{k}$$

(جـ) $s(\frac{88}{k}) = 242$

$$-\frac{k}{2}(\frac{88}{k})^2 + 88(\frac{88}{k}) = 242$$
$$\frac{3872}{k} = 242$$
$$k = 16 \text{ ft/sec}^2$$