

$$1. A = D - 1$$

$$B = D + 2$$

$$C = D^2 + D - 2$$

$$D = d/dt$$

$$y = t^3 - 8$$

$$a) A[y]$$

$$(D-1)[y] = D[y] - 1[y] = y' - y = (t^3 - 8)' - (t^3 - 8) =$$

$$= \underline{3t^2 - t^3 + 8}$$

$$b) B[A[y]]$$

$$\begin{aligned} D+2((D-1)[y]) &= D+2(D[y] - 1[y]) = D(D[y] - [y]) + 2(D[y] - [y]) = \\ &= (y'' - y') + (2y' - 2y) = y'' + y' - 2y = (t^3 - 8)'' + (t^3 - 8)' - 2(t^3 - 8) = \\ &= \underline{6t + 3t^2 - 2t^3 + 16} \end{aligned}$$

$$c) B[y]$$

$$\begin{aligned} (D+2)[y] &= D[y] + 2[y] = y' + 2y = (t^3 - 8)' + 2(t^3 - 8) = \\ &= \underline{(3t^2) + 2t^3 + 16 = 3t^2 + 2t^3 + 16} \end{aligned}$$

$$d) A[B[y]]$$

$$\begin{aligned} D-1((D+2)[y]) &= D-1(D[y] + 2[y]) = D(D[y] + 2[y]) - (D[y] + 2[y]) = \\ &= (y'' + 2y') - (y' + 2y) = y'' + y' - 2y = \underline{6t + 3t^2 - 2t^3 + 16} \end{aligned}$$

$$e) C[y]$$

$$(D^2 + D - 2)[y] = D^2[y] + D[y] - 2[y] = y'' + y' - 2y = \underline{6t + 3t^2 - 2t^3 + 16}$$