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16/ENG03/031

CIVIL ENGINEERING

ENG 882

ASSIGNMENT 3.

Solution.

Let  $T_1 = a$ ,  $T_2 = b$ ,  $T_3 = c$ ,  $T_4 = d$ ,  $T_5 = e$ ,  $T_6 = f$

$$a + b - 2c + d + 3e - f = 4 \quad \text{--- (i)}$$

$$2a - b + c + 2d + e - 3f = 20 \quad \text{--- (ii)}$$

$$a + 3b - 2c - d + 2e + f = -15 \quad \text{--- (iii)}$$

$$5a + 2b - c - d + 2e + f = -3 \quad \text{--- (iv)}$$

$$-3a - b + 2c + 3d + e + 3f = 16 \quad \text{--- (v)}$$

$$4a + 3b + c - 6d - 3e - 2f = -27 \quad \text{--- (vi)}$$

Put equation ii equ (i)

$$2(a + b - 2c + d + 3e - f = 4) = 2a + 2b - 4c + 2d + 6e - 2f = 8$$

$$1(a + b - 2c + d + 3e - f = 4) \quad 2a + 2b - 4c + 2d + 6e - 2f = 8$$

$$5(a + b - 2c + d + 3e - f = 4) \quad 5a + 5b - 10c + 5d + 15e - 5f = 20$$

$$-3(a + b - 2c + d + 3e - f = 4) \quad -3a - 3b + 6c - 3d - 9e + 3f = -12$$

$$4(a + b - 2c + d + 3e - f = 4) \quad 4a + 4b - 8c + 4d + 12e - 4f = 16$$

Subtract equations

$$2a - b + c + 2d - e - 3f = 20$$

$$-2a + 2b - 4c + 2d + 6e - 2f = 8$$

$$2 \quad -3b + 5c - 5e - f = 12 \quad \dots 2'$$

$$d + 3b - 3c - d + 2e + f = -15$$

$$-2a + b - 2c + d + 3e - f = 4$$

$$2 \quad 2b - c - 2d - e + 2f = 19 \quad \dots 3'$$

$$5a + 2b - c - d + 2e + f = -3$$

$$-5a + 5b - 10c + 5d + 15e - 5f = 20$$

$$2 \quad -3b + 9c - 6d - 13e + 6f = -23 \quad \dots 4'$$



$$-3a - b + 2c + 3d + e + 3f = 16$$

$$-8a - 8b + 6c + 2d - 2e + 3f = -10$$

$$2b - 4c + 6d + 10e = 28 \dots 5'$$

$$4a + 8b + c - 6d - 3e - 2f = -27$$

$$-4a + 4b - 8c + 4d + 12e - 4f = 16$$

$$-b + 7c - 10d - 15e + 2f = -43 \dots 6'$$

make eqn ⑤ new pivot equation

$$2/3 (-8b + 5c - 5e - f = 12) : 2b - 10c/3 + 10e/3 + 2f/3 = -8$$

$$-3/3 (-3b + 5c - 5e - f = 12) : -3b + 5c - 5e - f = 12$$

$$2/3 (-8b + 5c - 5e - f = 12) : 2b - 10c/3 + 10e/3 + 2f/3 = -8$$

$$-1/3 (-3b + 5c - 5e - f = 12) : -b + 5c/3 - 5e/3 - 1/3 f = 4$$

Subtract equations.

$$2b - c - 8e + 2f = -19$$

$$-2b - 10c/3 + 10e/3 + 2f/3 = -8$$

$$2 - 7c/3 - 2d - 13e/3 + 4f/3 = -11 \dots 3''$$

$$-3b + 7c - 6d - 13e + 6f = -23$$

$$-3b + 5c - 5e - f = 12$$

$$2 - 4c - 6d - 8e + 7f = -35 \dots 4''$$

$$2b - 4c + 6d + 10e = 28$$

$$-2b - 10c/3 + 10e/3 + 2f/3 = -8$$

$$2 - 2/3 c + 6d + 20/3 e = 2/3 f + 36 \dots 5''$$

$$-b + 7c - 10d - 15e + 2f = -43$$

$$-b + 5c/3 - 5e/3 - 1/3 f = 4$$

$$2 - 22/3 c - 10d - 40/3 e + 2/3 f = -47 \dots 6'$$



Make eqn (iii) new pivot equation.

$$-12/3 C + 7/3 C - 2d - 13/3 e + 4/3 f = -11 \Rightarrow 4C - 24/3 d - 82/3 e + 16/3 f = -132/3$$

$$+ 2/3 C + 7/3 C - 2d - 13/3 e + 4/3 f = -11 \Rightarrow -2/3 C + 4/3 d + 26/21 e - 8/21 f = 22/7$$

$$+ 2/3 C + 7/3 C - 2d - 13/3 e + 4/3 f = -11 \Rightarrow 22/3 C - 44/3 d - 286/21 e + 88/21 f = -242/3$$

Subtract equations.

$$4C - 6d - 8e + 4f = -33$$

$$- 4C - 24/3 d - 82/3 e + 16/3 f = -132/3$$

$$\Rightarrow -2.5714d - 0.5714e + 4.7142f = -16.1429 \quad \text{--- } 4''$$

$$- 2/3 C + 6d + 20/3 e - 2/3 f = 36$$

$$- 2/3 C + 4/3 d + 26/21 e - 8/21 f = 22/7$$

$$\Rightarrow 5.42857d + 5.42857e - 0.28571f = 32.85714 \quad \text{--- } 5''$$

$$82/3 C - 10d - 40/3 e + 7/3 f = -47$$

$$- 22/3 C - 44/3 d - 286/21 e + 88/21 f = -242/3$$

$$\Rightarrow -3.71429d + 0.285714e - 1.85714f = -12.4286 \quad \text{--- } 6''$$

Make eqn (4'') new pivot equation.

$$-2.1111C - 2.5714d - 0.5714e + 4.7142f = -16.1429$$

$$\Rightarrow 5.42857d + 1.2063e - 9.9524f = 34.0793$$

$$14.444C - 2.5714d - 0.5714e + 4.7142f = 16.1429$$

$$\Rightarrow -5.71429d - 0.82536e + 6.80947f = 23.3177$$

Subtract equations

$$5.42857d + 5.42857e - 0.28571f = 32.85714$$

$$- 5.42857d + 1.2063e - 9.9524f = 34.0793$$

$$\Rightarrow 4.2225e - 9.6663f = -1.222 \quad \text{--- } 5'''$$

$$- 3.71429d + 0.285714e - 1.85714f = -12.4286$$

$$- 3.71429d + 0.82536e + 6.80947f = 23.3177$$

$$\Rightarrow 1.1111e - 8.6667f = 10.8889 \quad \text{--- } 6'''$$

make eqn 5''' new pivot equation.

$$0.2652C + 2.222e + 9.6663f = -1.2222$$

$$\Rightarrow 1.1111e + 2.5442f = -0.32168$$



$$1111e - 8.667 = 10.8889$$

$$1.1111e + 2.84424 = 0.32168$$

$$-11.2107f + 11.2106$$

$$f = \frac{11.2106}{11.2107} = -0.9999732 \approx -1$$

$$1111e - 8.667(-1) = 10.889$$

$$e = \frac{10.889 - 8.6667}{1} = 2$$

$$1.1111$$

$$-3.71429d + 0.285714(2) - 1.85714(-1) = -12.4286$$

$$d = \frac{-12.4286 - 0.571428 - 1.85714}{-3.71429} = 4$$

$$= 3.71429$$

from equ (4<sup>th</sup>)

$$4c - 6d - 8e + 2f = -35$$

$$c = \frac{-35 + 4(4) + 8(2) - 2(3)}{4} = \frac{12}{4} = 3$$

from equ (5<sup>th</sup>)

$$2b - c - 2d - e + 2f = -19$$

$$2b - 3 - 2(4) - 2 + 2(-1) = -19$$

$$2b - 3 - 8 - 2 - 2 = -19$$

$$b = \frac{-19 + 15}{2} = \frac{-4}{2} = -2$$

from equ (1)

$$a + b - 2c + d + 3e - f = 4$$

$$a - 2 = 2(3) + 4 + 3(2) - (-1) = 4$$

$$a = 2 - 6 + 4 + 6 + 1 = 4$$

$$d = 4 - 3 = 1$$

$$a = 1, b = -2, c = 3, d = 1, e = 2, f = -1$$

$$\therefore T_1 = 1, T_2 = -2, T_3 = 3, T_4 = 1, T_5 = 2, T_6 = -1$$