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**CHAPTER 3**

**SOLUTION (1.1)**

(1) We obtain  
 $\frac{\partial^2 \Phi}{\partial x^2} = -12pxy$ ,  $\frac{\partial^2 \Phi}{\partial y^2} = 0$ ,  $\frac{\partial^2 \Phi}{\partial x \partial y} = 6pxy$   
Thus,  $\nabla^2 \Phi = -12pxy + 2(6pxy) = 0$   
and the given stress field represents a possible solution.

(2)  $\frac{\partial^2 \Phi}{\partial x^2} = pxy^2 - 2px^2y$   
Integrating twice  
 $\Phi = \frac{px^3y^2}{6} - \frac{px^4y}{2} + f_1(x) + f_2(y)$   
The above is substituted into  $\nabla^2 \Phi = 0$  to obtain  
 $\frac{d^2 f_1}{dx^2} + \frac{d^2 f_2}{dy^2} = 0$   
This is possible only if  
 $\frac{d^2 f_1}{dx^2} = 0$ ,  $\frac{d^2 f_2}{dy^2} = 0$   
We find from  
 $f_1 = c_1x^2 + c_2x + c_3$ ,  $f_2 = c_4y^2 + c_5y + c_6$   
Therefore,  
 $\Phi = \frac{px^3y^2}{6} - \frac{px^4y}{2} + (c_1x^2 + c_2x + c_3) + (c_4y^2 + c_5y + c_6)$

(3) Edge  $x=0$ :  
 $T_x = \int_0^h \sigma_x dh = \int_0^h (-2px^2 + c_1) dh = -px^2h + 2c_1h$   
 $T_y = \int_0^h \sigma_y dh = \int_0^h 0 dh = 0$   
Edge  $x=h$ :  
 $T_x = \int_0^h (-\frac{1}{2}px^3 + c_1h^2 + \frac{px^2}{2} + c_2) dh$   
 $= -\frac{1}{8}ph^4 - \frac{1}{2}px^2h^2 + 2c_1h^2 + c_2h^3$   
 $T_y = \int_0^h (pxh^3 - 2px^2yh) dh = 0$

**SOLUTION (1.2)**

Edge  $x = a$ :  
 $\tau_{xy} = 0$ :  $-\frac{1}{2}pa^2y^2 + c_1y^3 + \frac{1}{2}pa^2 + c_2 = 0$   
 $\tau_{yx} = 0$ :  $-\frac{1}{2}pa^2y^2 + c_1y^3 + \frac{1}{2}pa^2 + c_2 = 0$   
Adding:  $(-\frac{1}{2}pa^2 + 2c_1)y^2 + pa^2 + 2c_2 = 0$

(CONT.)

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