

## Answers to Selected Problems: Chapter 4

### 4.1

1.

(a) 12cm

(b) 0.6

2.

(a)  $\varepsilon = 1.0$ ,  $\varepsilon_t = 0.693$

(b)  $\varepsilon = -0.25$ ,  $\varepsilon_t = -0.288$

(c)  $\varepsilon = 0.5$ ,  $\varepsilon_t = 0.405$

3.

$\varepsilon_{xy} = 0.0015$

4.

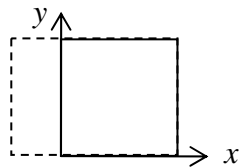
Small strains:  $\varepsilon_{xx} = 0.00225$ ,  $\varepsilon_{yy} = 0.002$ ,  $\varepsilon_{xy} = -0.00083$

Actual strains:  $\varepsilon_{xx} = 0.00225$ ,  $\varepsilon_{yy} = 2.001386 \times 10^{-3}$ ,  $\varepsilon_{xy} = -8.3166823 \times 10^{-4}$

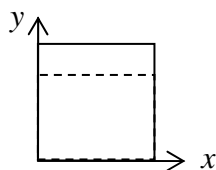
Errors: 0%, 0.069%, 0.200%

5.

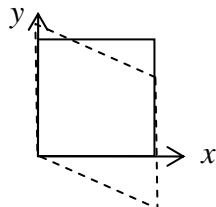
(i)



(ii)



(iii)



6.

$\varepsilon_{xx} = 0$ ,  $\varepsilon_{yy} \approx -3.8053 \times 10^{-3}$ ,  $\varepsilon_{xy} \approx 1.6646 \times 10^{-4}$

## 4.2

1.

(a)

$$\varepsilon_{xx} = 0.02, \varepsilon_{yy} = \varepsilon_{xy} = 0$$

$$\varepsilon'_{xx} = 0.015, \varepsilon'_{yy} = 0.005, \varepsilon'_{xy} = -8.66 \times 10^{-3}$$

(b)  $\varepsilon_1 = 0.02, \varepsilon_2 = 0$

(c)  $\max(\varepsilon_{xy}) = 0.01$

(d) 45 degrees.

2.

(a)  $\varepsilon_{xx} = 0.01, \varepsilon_{yy} = -0.01, \varepsilon_{xy} = 0$

(b)  $\varepsilon'_{xx} = 0, \varepsilon'_{yy} = 0, \varepsilon_{xy} = -0.01$

(c) the same as (b) using  $\theta = 45$

(d)  $\sqrt{1.0001} - 1$ . Close to (b).

3.

(a)  $\varepsilon_{xx} = 0.5, \varepsilon_{yy} = -0.5, \varepsilon_{xy} = 0$

(b)

$$\varepsilon'_{xx} = 0, \varepsilon'_{yy} = 0, \varepsilon_{xy} = -0.5$$

(c) the same as (b) using  $\theta = 45$

(d)  $\sqrt{2} - 1 \approx 0.414$ . Not the same as (b).