

1. a.  $0.00126, 4.02 \times 10^{-4}$   
 b.  $2.81828459 \times 10^{-4}, 1.03678896 \times 10^{-4}$   
 c.  $420, 0.0104166667$

2. a.

$$\text{a. } \frac{|\pi - p^*|}{|\pi|} < 10^{-4}$$

$$-\pi(10^{-4}) < \pi - p^* < \pi(10^{-4})$$

change signs       $-\pi(10^{-4}) < p^* - \pi < \pi(10^{-4})$

$$\pi - \pi(10^{-4}) < p^* < \pi + \pi(10^{-4})$$

$$(\pi - \pi(10^{-4})), (\pi + \pi(10^{-4})) \leftarrow$$

$p^*$  must be within this interval

b.

$$\text{b. } \frac{|e - p^*|}{|e|} < 10^{-4}$$

$$-e(10^{-4}) < e - p^* < e(10^{-4})$$

$$-e(10^{-4}) < p^* - e < e(10^{-4})$$

$$e - e(10^{-4}) < p^* < e + e(10^{-4})$$

$$e(1 - 10^{-4}) < p^* < e(1 + 10^{-4})$$

interval:  $(e(1 - 10^{-4}), e(1 + 10^{-4}))$

3.  $2020 - 2^{10} = 996 - 2^9 = 484 - 2^8 = 228 - 2^7 = 100 - 2^6 = 36 - 2^5 = 4 - 2^2 = 11111100100_2$

4. a.

Max:

$$(0.11111)_2 * 2^6 = (1 * 2^{-1} + 1 * 2^{-2} + 1 * 2^{-3} + 1 * 2^{-4} + 1 * 2^{-5}) * 2^6$$

$$(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} + \frac{1}{32}) * 2^6$$

$$62$$

Min:

$$(0.10000)_2 * 2^{-6}$$

$$(1 * 2^{-1} + 0 * 2^{-2} + 0 * 2^{-3} + 0 * 2^{-4} + 0 * 2^{-5}) * 2^{-6}$$

$$0.5 * 2^{-6} = 0.0078125$$

B.  $\sqrt{2} = 1.4142$

$$2^0 + 0 * 2^{-1} + 2^{-2} + 2^{-3} + 2^{-4} + 0 * 2^{-5} = 1.4375$$

$$(1.01110)_2$$