a)

k	i
0	$2 = 2^1$
1	$4 = 2^{2^1}$
2	$16 = 2^{2^2}$
3	$256 = 2^{2^3}$
4	$256^2 = 2^{2^4}$

$= 2^{2k}$

$n = 2^{2^k}$

$\log n = 2^k$

$\log(\log n) = k$

runtime: $\Theta(\log(\log n))$

b)

i	n=10 $\sqrt{10} = 3$
1	×
2	×
3	✓
4	×
5	×
6	✓
7	×
8	×
9	✓

if executes $\sqrt{n}$ times

$$\sum_{i=1}^{n} \Theta(1) + \sum_{i=1}^{\sqrt{n}} \left(\sum_{i=0}^{i^3-1} \Theta(1) \right) = \Theta(n) + \Theta(\sqrt{n} \cdot n^3)$$

runtime $= \Theta(n^{7/2})$

c) $$\sum_{i=1}^{n} \left(\sum_{i=1}^{n} \left(\sum_{i=1}^{n} \Theta(1) \right) \right) = \sum_{i=1}^{n} \left(\sum_{i=1}^{n} (\log n) \right) = n^2 \log n$$

runtime: $\Theta(n^2 \log n)$

m	k
$2^0 = 1$	0
$2^1 = 2$	1
$2^2 = 4$	2
$2^3 = 8$	3

d) $$\sum_{i=0}^{n-1} \Theta(1) + \sum_{i=0}^{n-1} \left(\sum_{j=0}^{3/2} \Theta(1) \right) = \sum_{i=0}^{n-1} 3/2 = \frac{3/2^{n+1} - 1}{3/2 - 1} = \frac{3/2^{n} + 3/2 - 1}{3/2 - 1} = \frac{3/2^{n} + 1/2}{1/2}$$

$$= (2(3/2)^n + 1/2)$$

$\Theta(n) + \Theta(3/2^n)$

runtime

size
10
$3/2$ 15
$3/2$ 22
33
49
73

runs $3/2$ size

a) in1 is returned

in1 [1] → [2] — [3] — [4]   in2 [5] → [6]

(in2, in1→next)

in1 in2

(1, 5)

in2 (5, 2) in1

in1 (2, 6) in2

in2 (null, 3) in1

return in2; ← actually in1

b) in2 is returned

in1=null in2=2

in1=null✓ return in2