

4.

```

int f (int n)
{
    int *a = new int [10];
    int size = 10;
    for (int i = 0; i < n; i++)
    {
        if (i == size) runs 2 @ 10
        {
            int newsize = 3*size/2;  $\frac{3}{2} \text{size}$ 
            int *b = new int [newsize];
            for (int j = 0; j < size; j++) b[j] = a[j];
            delete [] a;
            a = b;
            size = newsize;
        }
        a[i] = i*i;
    }
}

```

n=5

(int math)

$\text{size: } 10 \rightarrow 15 \rightarrow 22.5 \rightarrow 33.75 \rightarrow 50.625$

$$\sum_{i=0}^{n-1} O(1) + \sum_{i=0}^{\text{size}} O(1)$$

$n = 10 \left(\frac{3}{2}\right)^k$

$\log \frac{n}{10} = k \log \left(\frac{3}{2}\right)$

$\log_2 \left(\frac{n}{10}\right) = k$

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$$10 \times 1.5^0 \rightarrow 10 \times 1.5^1 \rightarrow 10 \times 1.5^2 \rightarrow 10 \times 1.5^3 \rightarrow 10 \times 1.5^4$$

$$\sum_{j=0}^k n = 10 \sum_{j=0}^k \left(\frac{3}{2}\right)^j = \Theta\left(\left(\frac{3}{2}\right)^k\right) \approx \Theta\left(\left(\frac{3}{2}\right)^k\right)$$

geometric series

$$\log_2 \left(\frac{n}{10}\right)$$

$$\log_2 \left(\frac{n}{10}\right) = \Theta\left(\left(\frac{3}{2}\right)^k\right)$$

$$= \Theta\left(\frac{n}{10}\right)$$

$$= \Theta(n)$$

Checking work:

$$\log_2 \left(\frac{n}{10}\right)$$

$$\begin{array}{l}
 \text{f=20} \\
 \text{i=10} \\
 \text{i=15} \\
 \text{i=22} \\
 \text{size=10} \\
 \text{size=15} \\
 \text{size=22...}
 \end{array}
 \approx \sum_{k=0}^{\log_2 \left(\frac{n}{10}\right)} 10 \cdot \Theta\left(\left(\frac{3}{2}\right)^k\right) \rightarrow \Theta(n) = \Theta(n)$$

* note, don't need to account for the outer loop again because we are already considering it in the inner iterations we need to calculate theta.