$$T(n) = 3T \left(\frac{n}{2}\right) + n^{2}$$

$$q = 3$$

$$\log_{0} q = \log_{2} 3 \approx 1.58 < 2$$

$$f(n) < n^{\log_{2} n + 2}$$

$$\Rightarrow T(n) = O(f(n)) = O(n^{2})$$

$$2) T(n) = 7T \left(\frac{n}{2}\right) + n^{2}$$

$$q = 7$$

$$d = 7$$

$$d = 7$$

$$d = 7$$

$$d = 0$$

$$f(n) > \int n^{\log_{2} n} = 0$$

$$f(n) = \int (n^{\log_{2} n}) = O(n^{\log_{2} n})$$

$$T(n) = 4T \left(\frac{n}{2}\right) + n^{2}$$

$$q = 4$$

$$d = 4$$

$$d = 4$$

$$d = 4$$

$$d = 2$$

$$d = 4$$

$$d = 2$$

$$f(n) = \int (n^{\log_{2} n}) = O(n^{2} \log_{2} n)$$

$$d = \int (n^{2} \log_{2} n) = O(n^{2} \log_{2} n)$$

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4)
$$T(n) = 9T(n/3) + n$$

 $a = 9$ $b = 3$
 $log_{1}a = log_{2}9 = 2 > 1$
 $f(n) > n log_{1}a - E$
 $\Rightarrow T(n) = \theta(n log_{2}a) = \theta(n^{2})$

5)
$$T(n) = T(2n/3) + 1$$

 $a = 1$ $b = 3/2$
 $log_b a = log_b 1 = 0 = 0$
 $f(n) = n log_b a$
 $f(n) = 0 (n log_b a) * log_b a (n log_b a)$

b)
$$T(n) = 3T(\frac{n}{4}) + n \log n$$

 $a = 3$ $b = 4$ $k = 1$ $p = 1$
 $\log_b a = \log_4 3 = 0.79 < 1$
 $f(n) < n \log_6 a + 2$
 $\Rightarrow T(n) = 0 (f(n)) = 0 (n \log n)$
7) $T(n) = 4T(n/2) + n \log n$
 $a = 4$ $b = 2$ $k = 2$ $n = 1$ > -1

 $T(n) = 4T(n/2) + n^{2}\log n$ a = 4 b = 2 k = 2 p = 1 > -1 $\log_{b} a = 2 = k$ $\Rightarrow T(n) = O(n^{k} \log^{p+1} n) = O(n^{2} \log^{2} n)$

9)
$$T(n) = 5T(n/2) + n^2 \log n$$

 $a = 5$ $b = 2$ $k = 2$ $p = 1$
 $\log_{10} a = 2 = 2, 32 > 2$
 $f(n) > n \log_{10} a = 0$
 $\Rightarrow T(n) = \theta(n \log_{10} a) = \theta(n \log_{10} b)$
 $= 10$
10) $T(n) = 2T(n/4) + C$
 $a = 2$ $h = 4$
 $\log_{10} a = 0, 5 > 20$
 $f(n) > n \log_{10} a - 2$
 $\Rightarrow T(n) = \theta(n \log_{10} a) = \theta(\sqrt{n})$
11) $T(n) = T(n/4) + \log_{10} n$
 $a = 1$ $b = 4$ $k = 0$ $p = 1$ > -1
 $\log_{10} a = 0 = k$
 $\Rightarrow T(n) = \theta(n \log_{10} a) = \theta(\log_{10} a)$

8) T(n)=4 T(n/2) + log n

 $\log_{b} a = 2 > 0$ $f(n) = n \log_{b} a - E$

q = 4 b = 2 k = 0 p = 1

 $\Rightarrow T(n) = \theta(n^{\log_{h^2}}) = \theta(n^2)$

12)
$$T(n) = 2T(n/4) + \log n$$

 $a = 2$ $b = 4$ $k = 0$
 $\log_b a = 0, 5 > 0$
 $f(n) > n \log_b a - \epsilon$
 $T(n) = \theta(n \log_b a) = \theta(f)$

$$f(n) > n \log_{n}$$

$$\Rightarrow T(n) = \theta(n \log_{n} \theta) = \theta(\sqrt{n})$$

$$\Rightarrow T(n) = 3T(n/3) + n \log n$$

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13)
$$T(n) = 3T(n/3) + n \log n$$

 $a = 3$ $b = 3$ $k = 1$ $p = 1 > -1$
 $\log_b a = 1 = k$

$$a = 3 \quad b = 3 \quad k = 1 \quad p = 1$$

$$log_b a = 1 = k$$

$$\Rightarrow T(n) = \theta(n k log^{p+1}n) = \theta(n log^2 n)$$

$$= 14) T(n) = 2T(n/4) + \sqrt{n}$$

$$T(n) = \theta(n \log^{p+1} n) = \theta(n \log^{2} n)$$

$$T(n) = 2T(n/4) + \sqrt{n}$$

$$a = 2 \quad b = 4$$

$$\log_{2} 2 = 0.5 = 0.5$$

$$T(n) = 2T(n/4) + \sqrt{n}$$

$$a = 2 \quad b = 4$$

$$og_4 2 = 0.5 = 0.5$$

$$f(n) = n \log_{10} 2$$

$$\Rightarrow T(n) = \theta(n \log_{10} 2 \log_{10} n) = \theta(\sqrt{n} \log_{10} n)$$

4)
$$T(n) = 2T(n/4) + \sqrt{n}$$

 $a = 2$ $b = 4$
 $\log_4 2 = 0.5 = 0.5$
 $f(n) = n \log_8 2$
 $\Rightarrow T(n) = 0 (n \log_8 2 \log_8 n) = 0 (\sqrt{n} \log_8 2 n)$

$$f(n) = n \log k^{a}$$

$$\Rightarrow T(n) = \theta (n \log k^{a} \log n) = \theta (\sqrt{n})$$

$$T(n) = 2 T (n/4) + n^{0.51}$$

$$q = 2 \qquad b = 4$$

$$q_{4} = 0.5 < 0.51$$

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$$a = 2$$
 $b = 4$
 $\log_4 2 = 0.5 < 0.51$
 $f(n) < \log_4 n \log_3 n + 2$
 $\Rightarrow T(n) = \theta(f(n)) = \theta(n^{0.51})$

|6|T(n) = |6T(n/4) + n|

20)
$$T(n) = 4T(n/2) + n/\log n$$

 $a = 4$ $b = 2$ $k = 1$ $p = -1$ $= -1$
 $\log_{1} a = 2$ > 1
 $f(n) > n \log_{1} a - \epsilon$

$$a = 4 \quad b = 2 \quad k = 1 \quad A = 1$$

$$\log_{10} a = 2 \quad > 1$$

$$f(h) > h \log_{10} a - 2$$

$$\log_{b} a = 2 > 1$$

$$f(n) > n \log_{b} a - \epsilon$$

$$f(n) > n \log_{b} a - \epsilon$$

$$f(n) = 0 (n \log_{b} a) = 0 (n^{2})$$

$$+(n) > n$$

$$+(n) > n$$

$$+(n) > n$$

$$+(n) = 0$$

$$a = 7 \quad b = 3 log_b a = 1,77 < 2 f(n) < n log_b a$$

$$= 1,77 < 2$$

$$f(n) < n \log_{b} a + \ell$$

$$\Rightarrow T(n) = 0(f(n)) = 0$$

$$f(n) < n \log_{b} a + c$$

$$\Rightarrow T(n) = O(f(n)) = O(n^{2})$$

$$22) T(n) = 8T(n/3) + 2^{n}$$

f(n) > n logg - E

 $\Rightarrow T(n) = \theta(n \log_2 \theta) = \theta(n^2)$

$$a = 8$$
 $b = 3$

23) T(n) = 16(T/4) + n $a = 16 \quad b = 4$

$$log_b a = 1.89$$
 $\Rightarrow n log_b a < 2^n$
 $f(n) < n log_b a + \varepsilon$

$$f(n) < n \log_{10} + \varepsilon$$

$$\Rightarrow T(n) = \theta(f(n)) = \theta(2^n)$$

 $log_{q} = 2 > 1$

$$f(n) < n^{2}$$
$$f(n) = \partial(f(n))$$

$$f(n) = 0$$

$$(n)) = 0$$

$$\frac{1}{2}(n) = 0$$

$$= \theta(n^2)$$

$$\theta(n^2)$$