

## Practice Exam 3

No calculators. Show your work. Clearly mark each answer.

1. Find the linear approximation of  $\sqrt[4]{x}$  at point  $a = 16$  and using it estimate  $\sqrt[4]{16.04}$ .
2. Evaluate the following limits:

(a)

$$\lim_{x \rightarrow 0} \frac{\tan(3x)}{\sin(2x)}$$

(b)

$$\lim_{x \rightarrow \infty} \frac{e^{x^2}}{x^2}$$

(c)

$$\lim_{x \rightarrow \infty} \left(1 + \frac{1}{2x}\right)^x$$

3. Find the minimum value of  $5a + 3b$  for  $a > 0$  and  $b > 0$ , such that  $ab = 25$ .
4. Using the following graphing guidelines sketch the function  $f(x) = x \ln^2 x$ :
  - (a) What's the domain of  $f(x)$ ?
  - (b) Is  $f(x)$  even or odd?
  - (c) Find  $f'(x)$ .
  - (d) Find  $f''(x)$ .
  - (e) Find the critical points (i.e. where  $f'(x) = 0$ ).
  - (f) Find inflection points (i.e. where  $f''(x) = 0$ ).
  - (g) Find the intervals on which the function is increasing, decreasing.
  - (h) Find the intervals on which the function is concave up, concave down.
  - (i) Identify extreme points.
  - (j) Locate vertical asymptotes
  - (k) Locate horizontal asymptotes
  - (l) Find  $x$ -intercepts (i.e. where  $f(x) = 0$ ).
  - (m) Find  $y$ -intercept (i.e. when  $f(0)$ ).
  - (n) Sketch the graph
5. Find the interval on which Rolle's Theorem applied to  $f(x) = x^2(x+3)$ . Find a point  $c$  in that interval at which  $f'(c) = 0$ .