Math. 250-01, Fall, 2015, Third exam answers, page 1

1 (a) $f'(x) = 2x+3$ (b) $f'(x) = 2e^{2x} + \ln(2)\,2^x$

(c) $f(x) = \sqrt{5}\,x^{3/2}$; $f'(x) = \frac{3}{2}\sqrt{5}\,x^{1/2} = \frac{3}{2}\sqrt{5x}$

(d) $f(x) = x^{-2}$; $f'(x) = -2x^{-3} = \frac{-2}{x^3}$

(e) $f'(x) = \ln(x) + x\left(\frac{1}{x}\right) = \ln(x) + 1$

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2 $f'(x) = 3x^2 - 3 = 3(x^2-1) = 3(x-1)(x+1) = 0$ at $x=1$ and $x=-1$.

$f''(x) = 6x$

$f''(-1) = -6 < 0$, so $\boxed{x=-1 \text{ corresponds to a local maximum}}$

$f''(1) = 6 > 0$ so $\boxed{x=1 \text{ corresponds to a local minimum}}$

3

x	$f(x)$
-1	4
1	0
-1.1	3.96
1.2	0.128

The global maximum is 4, and it occurs at $x=-1$, while the global minimum is 0, and it occurs at $x=1$.

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4 $\frac{C(q)}{q} = \frac{20}{q} + 2 + 0.05q$; $C'(q) = 2 + 0.1q$

$\frac{C(q)}{q} = C'(q) \Leftrightarrow \frac{20}{q} = 0.05q \Rightarrow \frac{20}{0.05} = q^2 = 400$

$\Rightarrow q = 20$

The minimum average cost occurs when $\boxed{\text{20 units}}$ are produced