

Answers to Math U141 Final Exam Fall 2007.

1a. $16x^3 + 9x^2 + 4x + 1$

1b. $e^{3x}(-2\sin(2x) + 3\cos(2x))$

1c. $x(x^2 + 25)^{-1/2}$

1d. $\frac{-\sin x - \sin^2 x - \cos^2 x}{(1 + \sin x)^2} = \frac{-\sin x - 1}{(1 + \sin x)^2} = \frac{-1}{(1 + \sin x)}$ (any version fine)

1e. $\frac{\sin x}{\cos x}$

1f. $\frac{2x}{3} - \frac{6}{x^3}$

2. a. $f'(x) = 6x^2 - 18x + 12$

critical points $P(1,6)$, and $Q(2,5)$

b. $f''(x) = 12x - 18$, $f''(1) = -6 < 0$, f CD at $P(1,6)$ so P is a LOCAL MAX,
 $f''(2) = 6 > 0$, f CU at $Q(2,5)$, so Q is a LOCAL MIN.

(OR use First Deriv Test involving sign of first derivative near $x=1$, $x=2$).

c. $f''(x) = 12x - 18 = 0$, $x = 1.5$, $f(1.5) = 5.5$.

d. Graph not shown. Remember to label points. If you use your Graphing Calculator to check your graph. Be sure to choose an appropriate window.

3.a. $\ln|x| + 9e^{x/3} - 2\cos(3x) + C$

b. $1.5x^4 - 4x^3 + e^x + 4$

c. 16.5

4a. 4.5 ml/hr

b. $\frac{f(4.01) - f(4)}{0.01} = \frac{(8.009975) - 8}{0.01} = 0.9975$

c. $y - 8 = 0.9975(x - 4)$

5. First find $v = -8x + 24$, $s = -4x^2 + 24x + 64$.

5a. Set $v=0$, $x=3$ seconds. 5b. $s(3)=100$ meters.

5c. $x=8$ seconds.

5d. $v(8)=-40$ meters/sec.

6. a. $y = 100e^{-0.0594t}$

b. 65.859 months

7. Minimize $C = 16x + 10y = 16x + 10\frac{4000}{x}$. Range $x > 0$.

Set $C' = 16 - 40,000x^{-2} = 0$. Ans. $x=50$ feet, $y=80$ feet.

8A. Find $C'(t) = 18e^{-0.03t} - 18t(-0.03)e^{-0.03t} = 18e^{-0.03t}(1 - 0.03t)$.

Time to peak: $33\frac{1}{3}$ min. Peak concentration 220.728 ng/ml.

8B. (a) $Q'(t)=2.5-0.347Q$.

(b). $Q=7.205$ mg/hr.

9.a LSum = $\frac{1}{3}\left(0 + \frac{5}{9} + \frac{8}{9} + 1 + \frac{8}{9} + \frac{5}{9}\right)$

9b (not drawn) (first rectangle has height 0, from $x=0$ to $x=1/3$, last has height $5/9$.)

10. $5\frac{1}{3}$.

11.a. $\int_0^9 v(t)dt$

b. 180 feet along path at 9:08 PM; 176 feet along path at 9:09 PM

c. 80 feet traveled/8 minutes: Ans: 10 feet/minute