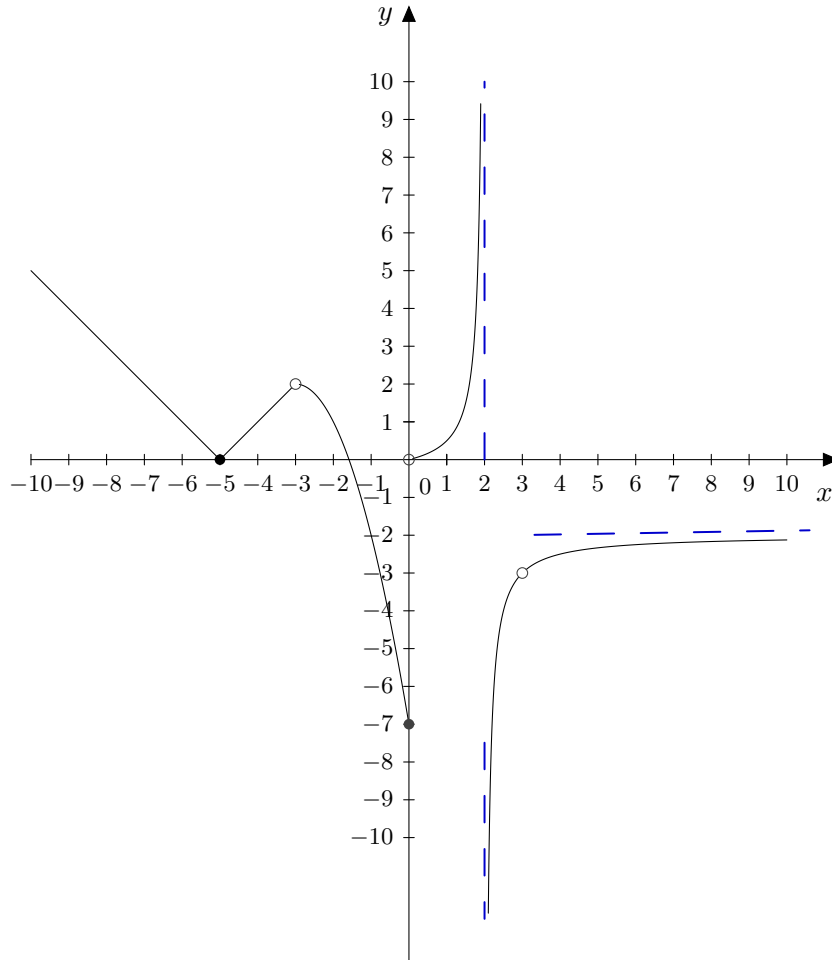


- (10) 1. For the function  $f(x)$  given in the diagram below, find each of the following limits. If the limit does not exist, write DNE or  $-\infty$  or  $\infty$  where appropriate. If the function is undefined at a point write und.



(a)  $\lim_{x \rightarrow -\infty} =$  \_\_\_\_\_

(e)  $\lim_{x \rightarrow 3^+} =$  \_\_\_\_\_

(b)  $\lim_{x \rightarrow \infty} =$  \_\_\_\_\_

(f)  $\lim_{x \rightarrow -3} =$  \_\_\_\_\_

(c)  $\lim_{x \rightarrow 0} =$  \_\_\_\_\_

(g)  $f(0) =$  \_\_\_\_\_

(d)  $\lim_{x \rightarrow 3^-} =$  \_\_\_\_\_

(h)  $f(3) =$  \_\_\_\_\_

(i) List points of discontinuity

2. Perform the indicated operation. Express the result in polar form.

(2) (a)  $\frac{15[\cos 200^\circ + j \sin 200^\circ]}{5[\cos 50^\circ + j \sin 50^\circ]}$

(2) (b)  $3[\cos 15^\circ + j \sin 15^\circ] + 7[\cos 30^\circ + j \sin 30^\circ]$

- (4) 3. Three oil pumps fill three different tanks. The pumping rates of the pumps (in L/h) are  $r_1, r_2$  and  $r_3$  respectively. Because of malfunctions, they do not operate at capacity each time. Find their rates.

$$r_1 + r_2 + r_3 = 14$$

$$r_1 + 2r_2 = 13$$

$$3r_1 + 3r_2 + 2r_3 = 36$$

4. Evaluate and express your answer in the form  $a + bj$ .

(3) (a)  $(4j - 3j^2 + 5j^7)(-2j^{24} + j^{26}) =$

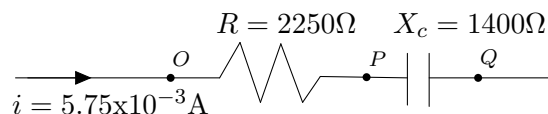
(3) (b)  $\frac{3j}{4-j} + \frac{6-j}{-1+j} =$

5. Solve the given equations if possible.

(3) (a)  $\frac{3^x}{27^{(1-x)}} = (243)^{x+1}$

(3) (b)  $-\log_5 x + \log_5(7x + 14) = \log_5(x + 2)$

6. Use the diagram below to determine;



- (1) (a) The voltage across the resistor (between points O and P)

- (1) (b) The voltage across the capacitor (between points P and Q)

- (2) (c) The voltage across the combination between Points O and Q.

- (2) (d) By what angle (in degrees) does the voltage lag the current.

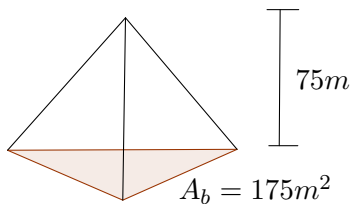
- (4) 7. A motorist traveling along a level highway at  $60 \frac{\text{km}}{\text{h}}$  directly toward a mountain notes that the angle of elevation of the mountain top changes from about  $10^\circ$  to about  $30^\circ$  in a 40 minute period. How much closer on a direct line did the mountain top become?

- (4) 8. Use De Moivre's theorem to evaluate  $[2j^{12} - 2j^{17} - j^{10} + 3j^5 - 4]^9$ . Express your answer in rectangular form  $a + bj$ .

9. Given the function  $f(x) = xe^{2x} + \sin 3x - 2x^3$  Find,

(2) (a)  $f'(x) =$

- (2) (b)  $f''(x) =$
- (2) (c)  $f'''(x) =$
- (1) (d)  $f'''(0) =$
- (3) 10. Find the x-coordinates on the curve  $f(x) = 2x^3 + 3x^2 - 180x + 50$  where the tangent line is horizontal.
- (4) 11. What is the volume of the pyramid below if it is only  $\frac{7}{8}$  complete.



12. Evaluate the given limits if possible.
- (3) (a)  $\lim_{x \rightarrow 5} \frac{x^2 - 2x - 15}{3x - 15}$
- (3) (b)  $\lim_{x \rightarrow 10} \frac{\frac{1}{5} - \frac{2}{x}}{x^2 - 100}$
- (3) (c)  $\lim_{x \rightarrow \infty} (x - \sqrt{x^2 - 3x})$
- (3) (d)  $\lim_{x \rightarrow 0} \frac{\sin(9x)}{x(x-1)}$
- (3) (e)  $\lim_{x \rightarrow \infty} \frac{(-3x^4 + 3)(4-x)}{3x + 7x^5}$
13. Solve the following trigonometric equation for  $x$  such that,  $x \in (0, 2\pi)$ .
- (4)  $\frac{1 + \sin x}{\cos x} + \frac{\cos x}{1 + \sin x} = 4$
- (4) 14. Find the equation of the tangent line to the curve  $y = \frac{3x}{x^2 + 3}$  at the point with  $x$ -coordinate equal to 1.
15. Find  $y'$  by differentiating the following;
- (3) (a)  $y = \frac{x^3}{4} + \frac{7}{\sqrt[3]{x}} + 5^x - \pi^e$
- (3) (b)  $y = x^9 \cos(5x)$

- (3) (c)  $y = (1 - x^2)^{\tan x}$  Hint: use logarithmic differentiation
- (3) (d)  $\ln(x + y) = 1 + x^{-2}$
- (4) 16. Determine the amplitude, period, phase shift and frequency of  $y = 4\sin(2x - \pi) + 2$ . Then sketch the function  $y$ .
- (3) 17. Solve the following system for  $x_3$  using Cramer's rule.
- $$\begin{array}{rcl} 3x_1 - 2x_2 & = & 7 \\ & x_2 + 5x_3 & = 1 \\ x_1 & + & x_3 = 5 \end{array}$$

### Answers Fall 2013

1. (a)  $\infty$   
 (b)  $-2$   
 (c) *dne*  
 (d)  $-3$   
 (e)  $-3$   
 (f)  $2$   
 (g)  $-7$   
 (h) *und*  
 (i)  $x = -3, 0, 2, 3$
2. (a)  $3[\cos 150^\circ + j \sin 150^\circ]$   
 (b)  $9.93[\cos 25.53^\circ + j \sin 25.53^\circ]$
3.  $r_1 = 3; r_2 = 5; r_3 = 6$
4. (a)  $-9 + 3j$   
 (b)  $-\frac{125}{34} - \frac{61}{34}j$
5. (a)  $x = -8$   
 (b)  $x = 7$
6. (a)  $V_R = 12.94V$   
 (b)  $V_C = 8.05V$   
 (c)  $V_{RLC} = 15.24V$   
 (d)  $\theta = -31.9^\circ$
7.  $38.17km$
8.  $-16 + 16j$
9. (a)  $f'(x) = e^{2x} + 2xe^{2x} + 3\cos 3x - 6x^2$   
 (b)  $f''(x) = 4e^{2x} + 4xe^{2x} - 9\sin 3x - 12x$   
 (c)  $f'''(x) = 12e^{2x} + 8xe^{2x} - 27\cos 3x - 12$   
 (d)  $f'''(0) = -27$
10.  $x = -6, 5$
11.  $V = 3828.13m^3$
12. (a)  $\frac{8}{3}$   
 (b)  $\frac{1}{1000}$   
 (c)  $\frac{3}{2}$   
 (d)  $-9$   
 (e)  $\frac{3}{7}$
13.  $x = \frac{\pi}{3}, \frac{5\pi}{3}$
14.  $y = \frac{3}{8}x + \frac{3}{8}$
15. (a)  $y' = \frac{3}{4}x^2 - \frac{7}{3\sqrt[3]{x^4}} + 5^x \ln 5$   
 (b)  $y' = 9x^8 \cos 5x - 5x^9 \sin 5x$   
 (c)  $y' = (1-x^2)^{\tan x} \left( \sec^2 x \ln(1-x^2) - \frac{2x \tan x}{1-x^2} \right)$   
 (d)  $y' = -\frac{2}{x^3}e^{1+x^{-2}} - 1$
16.  $A = 4; p = \pi; p.s = \frac{\pi}{4}; b = 2$
17.  $x_3 = -\frac{6}{7}$