

Mathematical Models 1  
201-115  
December 2008  
Final Examination

Instructor: Bob DeJean

*1 mark questions*

Calculate, giving your answer to the right number of significant digits:

$$(2.31 \times 10^4) (5.062 \times 10^{-1}) =$$

Write  $178^\circ$  in radians.

Which is bigger: 2 radians or  $113^\circ$  ?

Calculate:

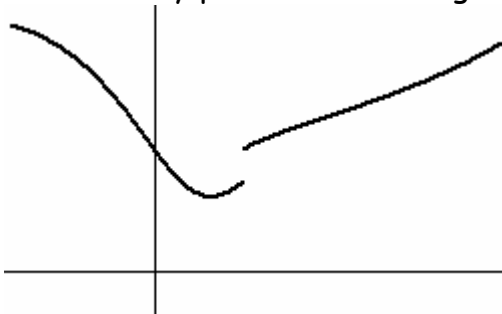
$$\log 7001 =$$

$$\ln 86.31 =$$

$$\log (-23) =$$

$$e^2 =$$

Is there any place where this graph is not continuous ?



Many years ago Toronto had 25 cycle electric current, that is the frequency was 25 Hz. My Dad says it was so slow you could see the lights flicker. What was the period of this current ?

What was its angular velocity ?

*(Three parts, one mark each)*

For  $y = 7x^6 - 6x^5 + 4321$

find  $y'$  =

and  $y''$  =

and even  $y'''$  =

*2 mark questions*

Pat and Tiffany are standing about 10 m from their campfire. To block some of the light, they hold up a sleeping bag. The sleeping bag is a rectangle, about 1.2 m by 2.1 meters. About what solid angle of firelight are they blocking ?



Alex had an aluminum cylinder, diameter 3 cm, 15 cm long. He put one end in a grinder, making that end a cone 4 cm high. The thing looks a bit like a freshly sharpened pencil. What is its volume?

Ryan took a circular saw and cut his bowling ball in half. What is the surface area of one of the halves? Before Ryan vandalized it, the ball had a diameter of 5 inches but no finger holes.

Solve for x and y:

$$3x + 2y = 46$$

$$5x - 3y = 7$$

Set up the determinants to solve for y by Cramer's Rule:

$$7x + 3y + 11z = 9$$

$$2x - 13z = 0$$

$$5x + 11y + z = 2$$

Use your determinants to calculate y. (It's gross!)

Find the magnitude and direction of the vector  $\overrightarrow{(8, 5)}$

Add:  $\overrightarrow{(3, 15)} + \overrightarrow{(-8, 6)} =$

Write using simple logs

$$\ln\left(\frac{6}{x^5}\right) =$$

Write using one log

$$\log 20 + \frac{1}{2} \log x =$$

Solve:  $\ln x + \ln(x + 2) = 4.143\ 134\ 8$

Find these limits:

$$\lim_{x \rightarrow 4} (x^2 - x) =$$

$$\lim_{x \rightarrow \infty} \frac{x}{\ln x} =$$

$$\lim_{x \rightarrow 2} \frac{x^3 - 2x^2}{3x - 6} =$$

Calculate

$$(4 + 3j) - (11 - 3j) =$$

$$(2 + 5j)(3 + j) =$$

$$\frac{12 + 5j}{2 - j} =$$

Write in rectangular form:

$$7 \angle 30^\circ =$$

Calculate:

$$\frac{40 \angle 85^\circ}{5 \angle 35^\circ} =$$

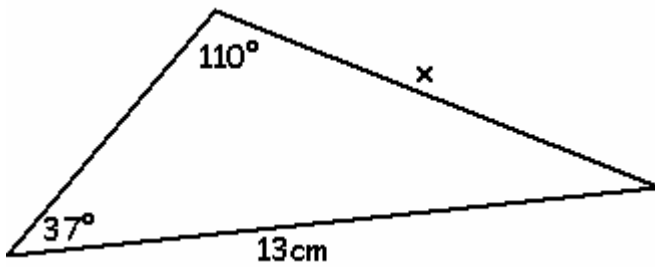
$$(4 \angle -6^\circ)^3 =$$

3 mark questions

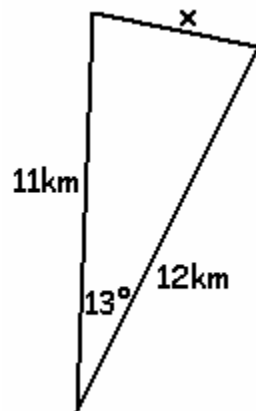
Find the fourth roots of  $625 / 60^\circ$

If you run a 60 Hz alternating current across a  $300\Omega$  resistor in series with a 5 Henry inductor, what is the resulting impedance ?

Find x:



Find x:



Solve for angle  $x$ :

$$3\sin x = 2$$

Find the derivative:

$$y = 32x - 2x^3$$

$$y = 12\sqrt{x} - 13$$

$$y = \frac{x^2 + 4}{x + 4}$$

$$y = 5(x^3 + 2)^7$$

$$y = \sqrt{7x - 6}$$

Find the derivatives

$$y = 16 \cos\left(\frac{1}{2}x\right)$$

$$y = 3x \tan x$$

Find the equation of the line tangent to  $y = \frac{x}{x+1}$  at the point  $(1, \frac{1}{2})$ .

*4 mark questions*

Sketch the graph of  $y = 6 \sin(8x + \pi/2)$

Vertical Shift =

Amplitude =

Phase Shift =

Period =

Use the limit definition to find the derivative of  $y = 3x^2$

Show your steps.



Answers

$$1.17 \times 10^4$$

3.1067

2 rads is bigger

3.8452

4.4579

sfa

7.3891

circle the break

1/25 sec

$$50 \pi = 157.08$$

$$42x^5 - 30x^4$$

$$210x^4 - 120x^3$$

$$840x^3 - 360x^2$$

0.0252 steradians

$$87.179 \text{ cm}^3$$

58.905 in<sup>3</sup>

$$x = 8 \quad y = 11$$

$$\begin{vmatrix} 7 & 9 & 11 \\ 2 & 0 & -13 \\ 5 & 2 & 1 \end{vmatrix}$$

$$\begin{vmatrix} 7 & 3 & 11 \\ 2 & 0 & -13 \\ 5 & 11 & 1 \end{vmatrix}$$

$$-372 / 1042 = -0.3618$$

$$9.4340 / \underline{32.00^\circ}$$

(-5, 21)

$$\ln 6 - 5 \ln x$$

$$\log (20 \sqrt{x})$$

-9 or 7

12

infinity

4/3

$$-7 + 6j$$

$$1 + 17j$$
$$(19 + 22j) / 5$$
$$6.0621 + 3.5j$$
$$8 / 50^\circ$$
$$64 / -18^\circ$$

$$5 / 15^\circ, 5 / 105^\circ, 5 / 195^\circ, 5 / 285^\circ$$
$$300 + 1885j$$
$$8.3257$$
$$2.7874$$

$$41.81^\circ +/- 360^\circ n \quad \text{and} \quad 138.19^\circ +/- 360^\circ n$$
$$32 - 6x^2$$
$$6 / \sqrt{x}$$
$$(x^2 + 8x - 4) / (x + 4)^2$$
$$105x^2 (x^3 + 2)^6$$
$$3.5 / \sqrt{7x - 6}$$

$$- 8 \sin(\frac{1}{2}x)$$
$$3 \tan x + 3x \sec^2 x$$
$$y = \frac{1}{4}x + \frac{1}{4}$$

sine wave with

$$VS = 0$$
$$\text{Amp} = 6$$
$$PS = -\pi/16$$
$$\text{Period} = \pi/4 \quad (\text{stops at } 3\pi/16)$$

limit formula, plugged in, simplified to  $6x$