

Name: SOLUTIONS

Student ID Number: \_\_\_\_\_

Teacher's name: \_\_\_\_\_

Course name: \_\_\_\_\_

Section number: \_\_\_\_\_

### Final Examination Rules

Before you begin your exam:

→ The use/possession of cell phones and other electronic devices is prohibited.

Dawson College  
Department of Mathematics

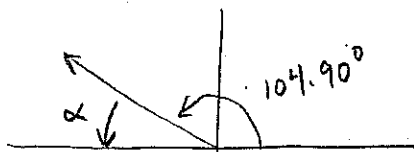
Final Examination  
Winter 2010

Introduction to Applied Mathematics (201 -912-DW)

Dawson College 2010

Page 21

$$\cos^{-1}(-0.2572) = 104.90^\circ$$



$$\alpha = 180^\circ - 104.90^\circ = 75.10^\circ$$

Question 2. (8 marks) Graph  $y = -2 \sin(3x - \pi)$ .

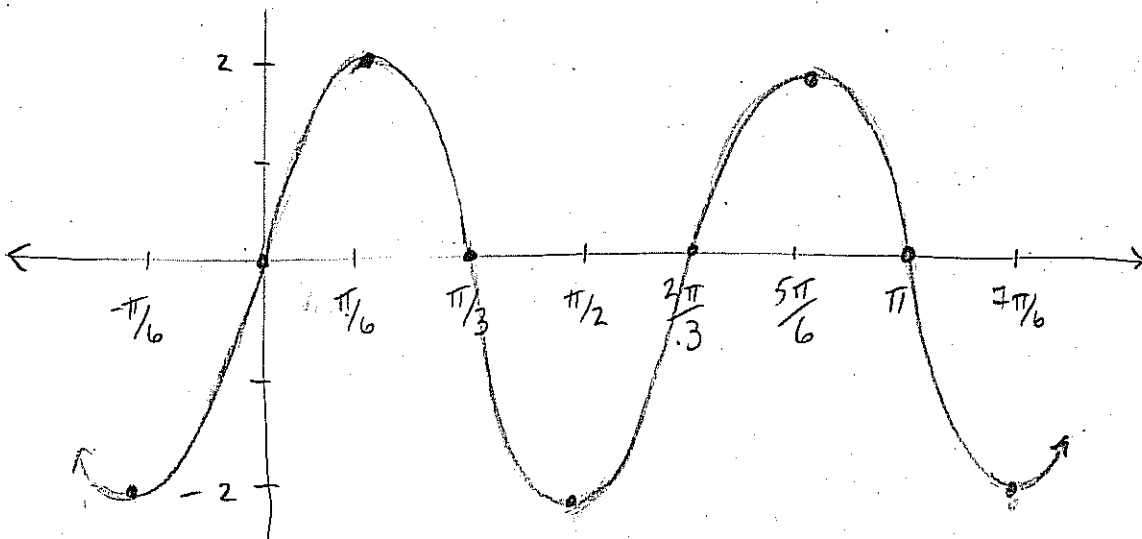
AMPLITUDE:  $|a| = 2$

PERIOD =  $\frac{2\pi}{3}$

PHASE SHIFT =  $-\frac{c}{b} = -\frac{(-\pi)}{3} = \frac{\pi}{3}$

$x$   $\frac{\pi}{3}$   $\frac{\pi}{2}$   $\frac{2\pi}{3}$   $\frac{5\pi}{6}$   $\pi$

$y$   $0$   $-2$   $0$   $2$   $0$



Question 3. (8 marks) Find the components, magnitude and standard position angle of the sum  $R$  of  $A = 237$ ,  $\theta_A = 137.5^\circ$  and  $B = 121$ ,  $\theta_B = 196.4^\circ$

$$A_x = A \cos \theta_A = 237 \cos 137.5^\circ = -174.735$$

$$A_y = A \sin \theta_A = 237 \sin 137.5^\circ = 160.115$$

$$B_x = B \cos \theta_B = 121 \cos 196.4^\circ = -116.077$$

$$B_y = B \sin \theta_B = 121 \sin 196.4^\circ = -34.163$$

$$\therefore R_x = A_x + B_x = -174.735 - 116.077 = -290.812$$

$$R_y = A_y + B_y = 160.115 - 34.163 = 126.952$$

$$\therefore R = \sqrt{(-290.812)^2 + (126.952)^2}$$

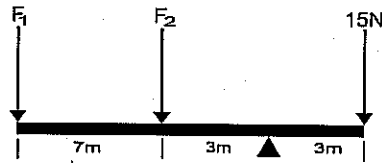
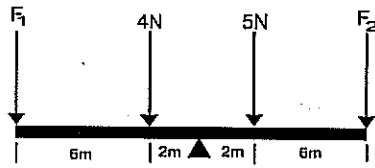
$$\tan \theta_R = \frac{126.952}{-290.812} \Rightarrow \tan^{-1} \left( \frac{126.952}{-290.812} \right) = 23.4^\circ = \alpha$$

$\theta_R$  IS IN QUAD II

$$\theta = 180^\circ - 23.4^\circ$$

$$= 156.6^\circ$$

Question 4. (8 marks) Use Cramer's rule to solve for  $F_1$  and  $F_2$  in the systems below that are in equilibrium. (Round to 3 significant figures)



$$8F_1 + 2(4) = 2(5) + 8F_2$$

$$8F_1 - 8F_2 = 10 - 8$$

$$8F_1 - 8F_2 = 2$$

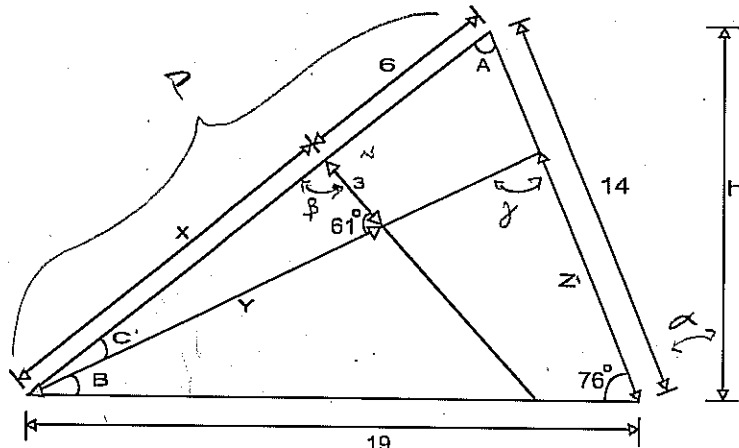
$$10F_1 + 3F_2 = 3(15)$$

$$10F_1 + 3F_2 = 45$$

$$F_1 = \frac{\begin{vmatrix} 2 & -8 \\ 45 & 3 \end{vmatrix}}{\begin{vmatrix} 8 & -8 \\ 10 & 3 \end{vmatrix}} = \frac{6 + 360}{8(3) - (-8)(10)} = \frac{366}{104} = 3.52\text{N}$$

$$F_2 = \frac{\begin{vmatrix} 8 & 2 \\ 10 & 45 \end{vmatrix}}{\begin{vmatrix} 8 & -8 \\ 10 & 3 \end{vmatrix}} = \frac{8(45) - 2(10)}{104} = \frac{340}{104} = 3.27\text{N}$$

Question 5. (10 marks) Determine the height  $h$  and the panel lengths  $X$ ,  $Y$  and  $Z$  of the roof truss. Also find the angles  $A$ ,  $B$ , and  $C$ . (Round to 3 decimal places)



$$\alpha = 90^\circ - 76^\circ = 14^\circ \Rightarrow \cos 14^\circ = \frac{h}{14} \Rightarrow h = 14 \cos 14^\circ = \underline{13.584}$$

$$D^2 = 19^2 + 14^2 = 710$$

$$= 428.297575$$

$$\therefore P = 20.695$$

$$= 20.695 - 6$$

$$= \underline{14.695}$$

$$\frac{14.695}{\sin 61^\circ} = \frac{3}{\sin C} \Rightarrow \sin C = \frac{3 \sin 61^\circ}{14.695} \Rightarrow \underline{C = 10.286^\circ}$$

$$\beta = 180^\circ - 10.286^\circ - 61^\circ = 108.714^\circ$$

$$\frac{Y}{\sin 108.714^\circ} = \frac{14.695}{\sin 61^\circ} \Rightarrow \underline{Y = 15.913}$$

$$\frac{19}{\sin A} = \frac{20.695}{\sin 76^\circ}$$

$$\Rightarrow \sin A = \frac{19 \sin 76^\circ}{20.695}$$

$$\therefore B = 180^\circ - 10.286^\circ - 71^\circ \Rightarrow \underline{A = 62.977^\circ}$$

Question 6. (10 marks)

(a) Evaluate  $\sqrt{224(3167)^{167}} = x$

$$\log = \frac{\log(224(3167)^{167})}{2} = \frac{\log 224 + 167 \log 3167}{2}$$

$$= 585.7834$$

$$\therefore x = 10^{585.7834} = 10^{585} \cdot 10^{0.7834} = 6.07 \times 10^{585}$$

(b) Solve for  $x$  in  $\log(x-1) + \log(3x+2) = 2$

$$\log(x-1)(3x+2) = \log 10^2$$

$$(x-1)(3x+2) = 100$$

$$3x^2 - 3x + 2x - 2 = 100$$

$$3x^2 - x - 102 = 0$$

$$x = \frac{-(-1) \pm \sqrt{(-1)^2 - 4(3)(-102)}}{2(3)} = \frac{1 \pm \sqrt{1225}}{6} = \frac{1 \pm 35}{6}$$

$$= -5, 7, 6$$

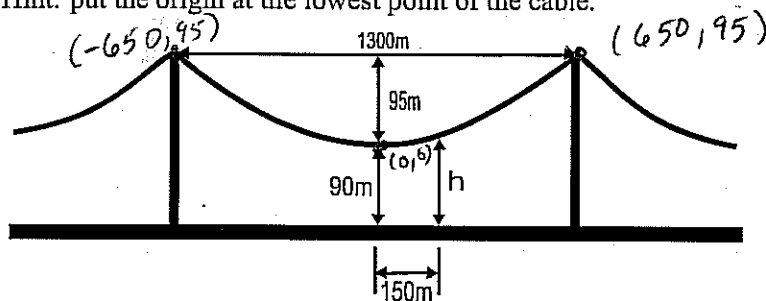
Question 7. (5 marks) In curing concrete the strength  $f_c$  after  $t$  days of curing is given by the equation

$$f = f_c(1 - e^{-kt})$$

where  $f_c = 48\text{Mpa}$  is the ultimate strength. If  $k = 0.1045$  how long does it take for concrete to achieve 75% of its ultimate strength.



the height  $h$  of the cable 150m from the lowest point of the cable? (Round to 4 significant figures).  
 Hint: put the origin at the lowest point of the cable.



$$y = ax^2 + bx + c$$

$$0 = a(0)^2 + b(0) + c \Rightarrow c = 0$$

$$95 = a(650)^2 + b(650) \Rightarrow 95 = 422500a + 650b$$

Question 9. (8 marks) Find the point(s) of intersection of the line that passes through the point (1, 3) with slope  $m = 3/4$  and the circle  $2x^2 + 2(y - 4)^2 = 50$ . Is this line a tangent line, secant line, or neither?

$$y = mx + b \quad \rightarrow \quad 12 - 3 = b$$

$$x^2 + (y - 4)^2 = 25$$

$$x^2 + \left(\frac{3}{4}x + \frac{9}{4} - 4\right)^2 = 25$$

$$x^2 + \left(\frac{3}{4}x - \frac{7}{4}\right)^2 = 25$$

$$x^2 + \frac{9}{16}x^2 - \frac{42}{16}x + \frac{49}{16} = 25$$

$$16x^2 + 9x^2 - 42x + 49 = 400$$

$$25x^2 - 42x - 351 = 0$$

**Question 10.** (8 marks) In testing an air-conditioning system that was recently installed in a building, the temperature in a building was measured during the afternoon hours with the results

below. Find the least squares-line and graph this line over a plot of the data points. What would you expect the temperature to be in the building at 5.0 hours?

time in hours (x)	0.0	1.0	2.0	3.0	4.0	5.0
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