

Note to The Student/Parent

This package presents in depth review for Level II Advanced and Academic Mathematics. Problems indicated by \* are for Advanced Math 2205 students only and would not appear on an Academic Math 2204 exam. While this review package is extensive, it is a very good indication of what to expect on an exam for the unit. All questions presented below are long answer type questions. They are no means an indicator of the objective type questions. Practicing with the long answer type questions will prepare you for the multiple choice questions. Should you have any questions about certain problems, feel free to inquire either during or outside of regular class time.

## Unit 1 Investigating Equations in 3-Space

1 The monthly charges for three phone plans are shown below where C represents the cost in dollars and t represents the long distance time in minutes you spend calling on the phone.

$$C = .2t + 10 \text{ Plan 1}$$

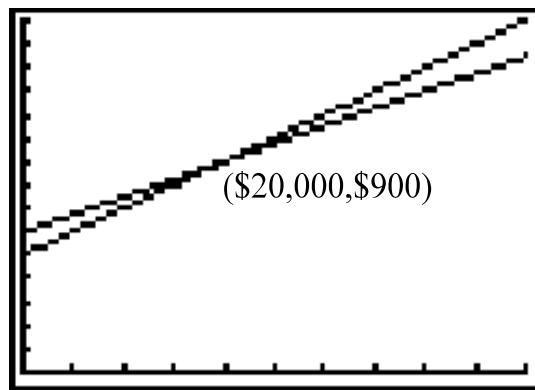
$$C = .1t + 15 \text{ Plan 2}$$

$$C = 25 \text{ Plan 3}$$

- A) Describe each phone. How do you know each plan has monthly base charges?
- B) Graph all three plans on the same x-y plane using quadrant one only.
- C) Determine when Plan 1 is the best for the consumer?
- D) Determine when Plan 1 and Plan 2 will cost the same?
- E) When is it best for the consumer to consider using Plan 3?
- F) Create another plan that has a common solution with Plan 2 and Plan 3.

2 Earnings  
\$

represents two  
to you by your



Car Sales (\$5000s)

The graph at the left  
payment <sup>1000</sup> plans presented  
employer.

- A) Create an equation for both plans. Identify your variables.
- B) Which plan would you choose if you averaged more than \$20,000 in sales per week? Why?
- C) Which plan would you choose if you sold less than \$10,000 in sales?
- D) Introduce another plan whereby the employer will pay you 4% of sale but only guarantee you \$300 a week?
- E) Will all three plan intersect?
- F) When is the plan you introduced in D the best for you the employer?

3 Solve the systems below by graphing the lines on the same x-y plane. Determine the type of system you solved and write the equations of another equivalent system.

$$A) \begin{cases} 2x - y = 0 \\ 3x + 4y = 11 \end{cases} \quad B) \begin{cases} x + y = 2 \\ -y - x = -2 \end{cases}$$

$$\begin{cases} y = x \\ y = -\sqrt{3}x + 4 + \sqrt{12} \end{cases} \quad \begin{cases} 2x - y = 3 \\ -2x + y = -3 \end{cases} *$$

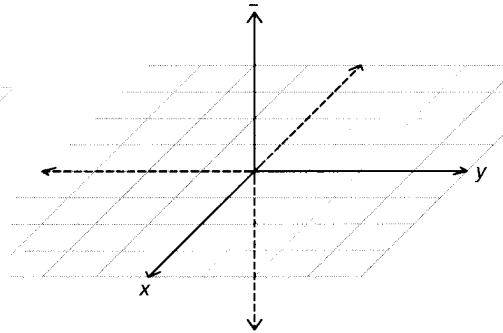
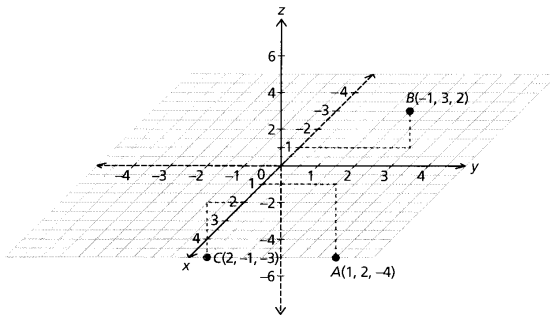
\*4 Solve the following system algebraically

\*5 Find the orthocenter of a triangle that has vertices A(-6,0), B(4, -4) and C(-3,-12). To save time, please use the intersection of altitudes from AB and BC.

\*6 If  $ax + 9y - 20 = 0$  and  $2x + by = 10$  are equations of the exact same line, what is the value of  $a/b$ ?

7 Using the three dimension plane below, plot the following points. You should use the plane on the left as a guide.

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- A) (4, 6, 8)      B) (-3, 6, 0)      C) (0, 0, 9)      D) (2, 5, -3)

8 For each plane below A) identify the intercepts B) give a sketch of the plane on a three space axis C) find the equation of all three traces D) give the coordinates to a point on each trace

- A)  $2x + y + 3z = 6$   
 B)  $4x - 6y + z = 24$   
 C)  $F = .10u + .20c + 20$   
 D)  $*50F + 20u - 10C + 4000 = 0$

\*9 Describe the intersection of the two planes given in each system below:

A)  $\begin{cases} 2x - y + z = 10 \\ z = 4 \end{cases}$       B)  $\begin{cases} x + y + z = 11 \\ 2x + 2y + 2z = 22 \\ -x - y - z = -11 \end{cases}$       C)  $\begin{cases} x + y = 3 \\ y + z = 5 \\ x + z = 4 \end{cases}$

10 Solve the following systems by algebraic substitution

$$\begin{array}{l}
 A) \begin{cases} 2x - y = 1 \\ 3x - 4y = -1 \end{cases} \quad B) \begin{cases} \frac{1}{4}x - 2y = 1 \\ \phantom{\frac{1}{4}x} - 1 \phantom{- 2y} = \phantom{1} \end{cases} \quad C) \begin{cases} 1.2x - 4.8y - 8 = -18.8 \\ 4x - 4.5y = -13 \end{cases} \\
 A) \begin{cases} 2x - y - 3z = -11 \\ x + y + z = 3 \\ x - y + 4z = -2 \\ x + y = z - 1 \end{cases} \quad B) \begin{cases} 3x + 4y - 2z = 7 \\ 2x - 3y + z = -16 \\ 5x - 2y - 3z = -7 \\ x - y - 2z = -19 \end{cases} \quad C) \begin{cases} 2x + 7y = -5 \\ 7x + 4y = 3 \end{cases}
 \end{array}$$

11 Use Elimination to solve these systems.

12 Set up a matrix equation and solve the following systems.

$$\begin{array}{l}
 A) \begin{cases} x - y = 1 \\ x + y + z = 6 \\ x = y + z - 2 \end{cases} \quad B) \begin{cases} 6x - z + y = 3 \\ x + y + z = 5 \\ 3x - y + z = -1 \end{cases} \quad *C) \\
 \begin{cases} x + y = 1 \\ y + z = 3 \\ x + z = 2 \\ y + w = 4 \end{cases}
 \end{array}$$

13 Find the inverse of the following matrices manually if they exist.

$$A) \begin{Bmatrix} 24 & 1 \\ 4 & \frac{1}{6} \end{Bmatrix} \quad B) \begin{Bmatrix} 4 & 9 \\ 1 & 2 \end{Bmatrix} \quad *C) \begin{Bmatrix} a & 4 \\ 2a & 8 \end{Bmatrix} \quad *D) \begin{Bmatrix} a & 9 \\ 4a & 4 \end{Bmatrix}$$

In questions 14 to 20 set up a 2x2 or 3x3 system of equations and use a method of your choice to solve the system and answer the problem.

14 A phone company in Canada will give customers certain rates for calling within and outside Canada. Three businesses agreed to share the break down of their bills below.

Business	Time within Canada(min)	Time to The US	Time Overseas	Charges
A	300	20	10	37.00
B	200	400	0	100.00
C	400	50	300	140.00

Determine the rates charge by the phone company by setting up an appropriate system of equations and solving it by a method of your choice.

15 From a soil analysis, Mr. Brown learned that his lawn will be healthier if he applies 60 kg of fertilizer that is 21% nitrogen. He already has a supply of fertilizer, some 10% nitrogen and some 30% nitrogen. How much of each kind should be mixed together for the lawn?

16 A golf ball is hit from the tee and after 1 second it has traveled 43.3 m. After 3 seconds it has traveled 121.5 meters. If the ball is hit from ground level, determine a quadratic equation for the path of the ball. Using your equation determine how far the ball traveled after 3.5 seconds.

17 A ball is thrown from a height of 4m. It is at a height of 2.2m after .4s, .85m after .6s and .2 m after .1 s. What is its height after it is in the air for .3s?

18 A) Page 68 Number 20 \*B) Page 45, 23 \*C) Page 35, 42

\*19A 8000 ml solution is made from three different concentrations of  $\text{AgNO}_3$ . Solution A is 20%  $\text{AgNO}_3$ , solution B is 30%  $\text{AgNO}_3$  and solution C is 40%  $\text{AgNO}_3$ . If you wish to make a fourth solution that is 35%  $\text{AgNO}_3$  from all three and you use twice as much as solution B as A, how much of solution A did you use?

\*20(0,2,1.6), (1,2,1.2) and (3,2,4) are points that lie on the same plane. Find the equation of the plane.

## Unit III Sinusoidal Functions

- 1 Define the following terms:
- i amplitude
  - ii period
  - iii sinusoidal axis
  - iv local maximum, local minimum
  - v sinusoidal function
  - vi periodic function

2 The rotation of a Ferris wheel is an example of periodic as well as sinusoidal behavior. In your own words, explain what does this mean.

3 Joan is riding a Ferris wheel. Her height above the ground in meters with respect to time in seconds can be represented by a graph. The graph begins at a y-intercept of 12 m. The first local minimum is located at (6s, 2 m). A local maximum is located at (18s, 22m).

- i Sketch the graph of Joan riding the Ferris wheel for at least two periods.
- ii Explain in relation to the wheel what does each of the following represent.
  - A) amplitude
  - B) period
  - C) sinusoidal axis
- C) Find the speed of the wheel.

4 Using your TI-83 calculator, determine if each graph is periodic, sinusoidal, or neither.

- D)  $y = \tan x$       B)  $y = \sin x \tan x$       C)  $y = \cos(2x)$
- D)  $y = -3x$       E)  $y = \sin x + \cos x$       F)  $y = \cos x \tan x$

5 Graph each function using transformations for at least two periods. Be sure identify

- i) period      ii) amplitude      iii) sinusoidal axis      iv) domain      v) range
- vi) mapping rule      vii) a table of values for the base function (IE  $y = \sin x$  or  $y = \cos x$ )
- viii) a table of values for your new function in functional form

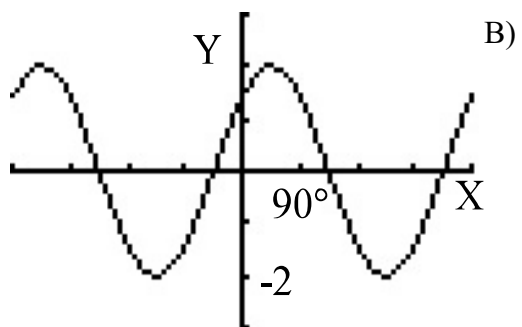
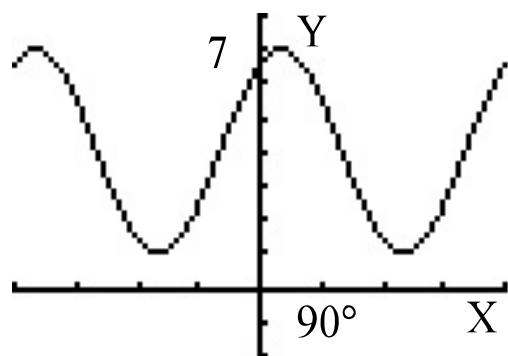
A)  $(y - 4) = \sin 2(x - 45^\circ)$       B)  $y = \cos 3(x + 60^\circ)$

C)  $2y = \sin \frac{1}{2}(x + 60^\circ)$       D)  $\frac{1}{3}(y - 5) = \cos 2(x + 30^\circ)$

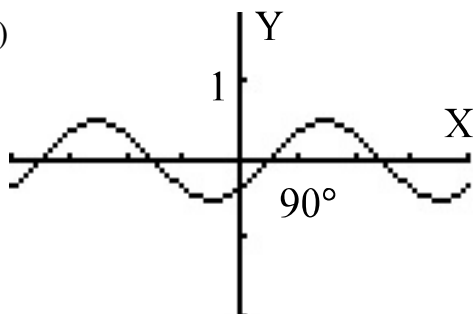
E)  $y = -2\cos .5(x - 60^\circ) + 4$       \*F)  $-3(y - 4) = \sin 3(x - 10^\circ)$

6 Find a cosine wave and a sine wave for the graph displayed below in transformational and functional form.

A)



C)



7 A small pebble is stuck in Morgan's bike tire. The wheel has a diameter of 68 cm. It takes 4 seconds for the tire to complete one revolution. Determine the equation of the function that expresses the height of the pebble from the ground in terms of the distance the bike travels from the point where the pebble got stuck in the tire.

8 Repeat question 7 with a tire that has a radius of 40 cm and a period of 6 seconds.

9\* A skyscraper sways 40 cm to the left and right from its starting position. At  $t = 2$  s, the building swayed 40 cm to the left and at  $t = 15$  s the building sways 40 cm to the right.

A) What is the equation of the sinusoidal functions that describes this sway?

B) What is the location of the building from its starting position at  $t = 18$  s?

10\* A submarine exhibits sound waves under water that will display sine wave from time to time. The sonar device records decibels on the vertical axis and time in seconds on the

horizontal axis. At  $t = \frac{1}{8}$  s the sounds recorded displayed a minimum value of 40

decibels. At  $t = \frac{1}{4}$  s the sounds displayed a maximum value of 60 decibels.

Determine

the equation of the function that expresses the sound waves in relation to time in functional form. What is the decibel of the sound at 1.5 s?

## Unit 6 Applications of Trigonometry

1 State the law of sines, cosines and area of the triangle formula for  $\triangle RFG$ .

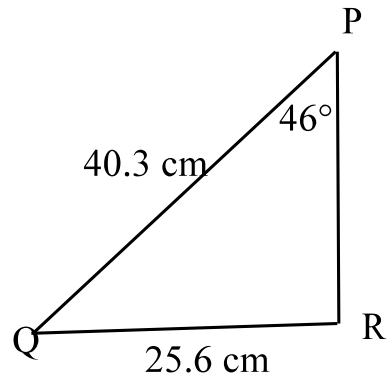
2 The sides of a parallelogram are 20 and 30 cm. If the included angle is  $150^\circ$ , what is the exact measure of the smallest diagonal?

3 A 6 meter ladder makes a  $67^\circ$  angle with the ground to reach a certain window. How much of an angle would a 8 meter ladder make with the ground to reach the same window from the outside?

4 Observers at J and K 3 km apart sight a plane at different angles of elevation. It is known that the angle of elevation from J is  $30^\circ$ . If the plane is 3.5 km from observer K, what is the angle of elevation from K to the plane?

5 Two ships leave St. John's, NL at 12:00. One travel in the direction of NE  $52^\circ$  at a speed of 20 knots. The other ship heads in the direction of SE  $170^\circ$  from North at 15 knots. How far apart are the ships at 16:00 in knots? (1 knot is a nautical mile roughly 1.85 km...this is not

necessary to know.)



6 Find the value of q below?