FALL 2021 - FINAL EXAMINATION Dawson College - Mathematics Department Applied Mathematics (201-923-DW S01) (Laboratory Technology - Analytical Chemistry)

201-923-DW 01 FALL 2021	Name:	
Final Examination December 16 th , 2021	ID#:	
Time Limit: 3 hours	Instructor:	E. Richer

- This exam contains 13 pages (including this cover page) and 14 problems. Check to see if any pages are missing.
- Answer the questions in the spaces provided on the question sheets. If you run out of room for an answer, continue on the back of the page, and please indicate that you have done so.
- Give the work in full; { unless otherwise stated, reduce each answer to its simplest, exact form; { and write and arrange your exercise in a legible and orderly manner.
- You are only permitted to use the Sharp EL-531X, XG or XT calculator.
- This examination booklet must be returned intact.
- Good luck!

Question	Points	Score
1	7	
2	9	
3	8	
4	8	
5	7	
6	9	
7	10	
8	10	
9	4	
10	7	
11	6	
12	6	
13	4	
14	5	
Total:	100	

1. (7 marks) Consider the function

 $f(x) = \log_3(2x+1)$

(a) State the domain f(x)

(b) State the range of f(x)

(c) Plot y = f(x) in the space provided below. Include at least 4 di erent properly labelled points. Make sure that the general shape of the function is clearly illustrated.

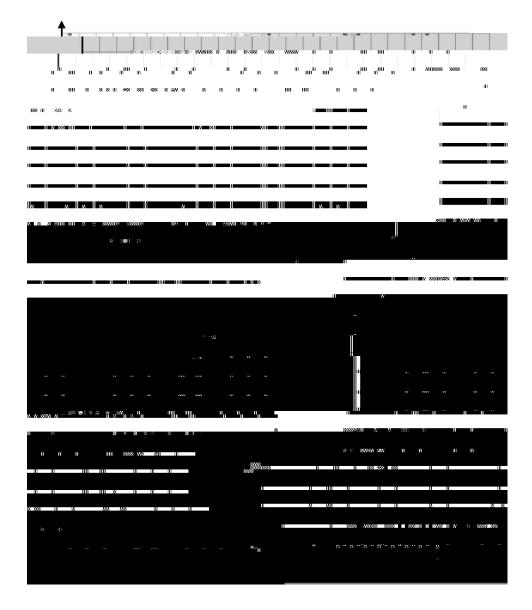
2. (9 marks) Consider the following ma	atrices:	2 3
Let $A = \begin{pmatrix} 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$, $B = \begin{pmatrix} 2 \\ 4 & 2 \\ 0 \end{pmatrix}$	$\begin{array}{ccccccc} 0 & \frac{7}{2}, & C = & 2 & 1 \\ 1 & 5, & C = & 1 & 3 \\ 0 \end{array}, & D = & \begin{array}{cccccccccc} 1 \\ 0 \end{array}$	$\begin{array}{cccccccccccccccccccccccccccccccccccc$
(a) Compute (where possible): i. $A^T + B$		
ii. <i>CD</i>		
iii. DE		
iv. <i>C</i> ¹		
(b) Which of the matrices are in ro	w-echelon form?	

(c) Which of the matrices are in reduced row-echelon form?

3. The height of an arch H(x) (in feet) as a function of horizontal distance x (in feet) from one extremity of its base is given by:

$$H(x) = \frac{3}{8}x^2 + 9x$$
; where 0 x 24

(a) (4 marks) Plot the function H(x) making sure to include at least 4 properly labelled points. The sketch should clearly indicate any intercepts as well as the vertex.



- (b) (2 marks) What is the highest point of the arch?
- (c) (2 marks) What is the height of the arch 8 feet from its centre?

5. Consider the functions:

$$f(x) = 2x + 1$$
 $g(x) = \frac{x}{x + 1}$ $h(x) = \frac{p_{\overline{2x + 6}}}{2x + 6}$

(a) (3 marks) State the domain of f, g and h.

(b) (4 marks) Compute the following:

i.
$$f(1 + x)$$

- ii. g(a + 3)
- iii. $\frac{h(-2)}{1+h(x)}$

6. (a) (3 marks) If $\log x = 5$, $\log y = 2$, $\log z = 3$ and $\log \frac{xy^3}{z}$.

(b) (4 marks) In each case, express as a single logarithm with coe cient 1.
i. 5 ln x 3 ln y ln 5

ii. log₂ x 8

(c) (2 marks) Evaluate $\log_3 \frac{x}{5} \qquad \log_3 \frac{x}{15}$

7. (10 marks) Solve the systems of equations correspondings)[]0 d 0 J 0.3726(2021)]TJETqted1

(a) (5 marks)

 $2^{2} \ ^{3x} = 5^{2x} \ ^{5}$

(b) (5 marks)

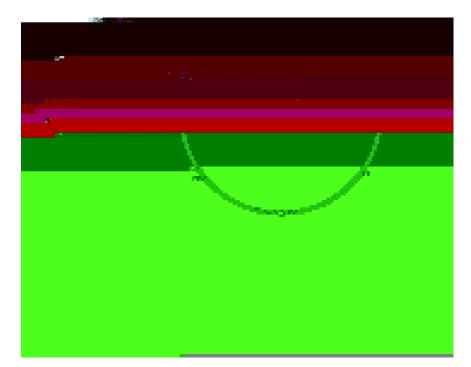
 $\log_2(x) + \log_2(x - 3) = 2$

9. (4 marks) Find the exact value of

$$\cos\frac{5}{4} + \tan\frac{4}{3}$$

10. (7 marks) Solve for giving all solutions (in radians) contained in the interval [0,2).

11. (6 marks) Find the area of the shaded portion bounded by a chord of length 8cm in a circle of radius 3.5 cm (as illustrated below).



12. (6 marks) Given a system of three equations and two unknowns, explain the geometric signi cance of:

14. (5 marks) Using the graph of $z = \log y$ with respect to x, illustrated below, nd the formula for the function y = f(x).

