

Dawson College Department of Mathematics

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- This exam has 13 pages (including this cover page) and 18 problems for 100 marks. Make sure you have a complete exam before starting.
- Attempt every question and **SHOW ALL YOUR WORK**. Marks will not be awarded for solutions with no work shown.
- If you need more space, use the back of the pages; clearly indicate when you have done this.
- Only the department approved Sharp EL-531** calculators are permitted.
- Selected Formulas:

$$V \approx \frac{A_b}{4}(\Sigma h_1 + 2\Sigma h_2 + 3\Sigma h_3 + 3\Sigma h_4)$$

$$A \approx \frac{d}{3}[h_1 + h_n + 4 \sum_2^{n-1} h_{\text{even}} + 2 \sum_3^{n-2} h_{\text{odd}}]$$

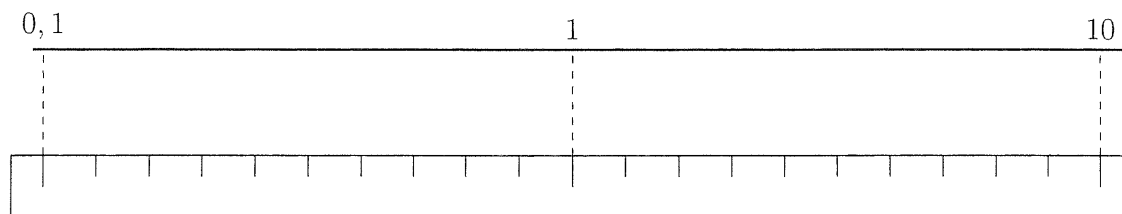
Problem	Points	Score
1	5	
2	5	
3	10	
4	7	
5	7	
6	6	
7	7	
8	6	
9	4	
10	5	
11	2	
12	2	
13	2	
14	5	
15	4	
16	5	
17	12	
18	6	
Total:	100	

1. (5 marks) Place the following numbers on a base 10 logarithmic scale, show your work:

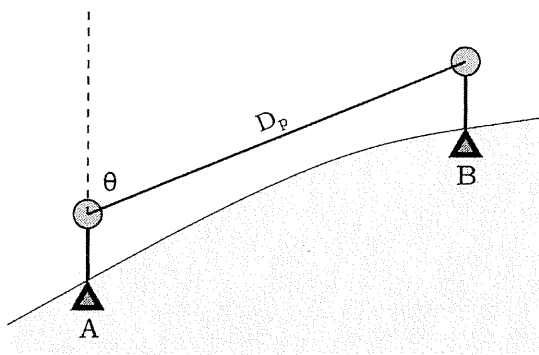
A. $10^{0.7}$

B. 0.38

C. 6.3



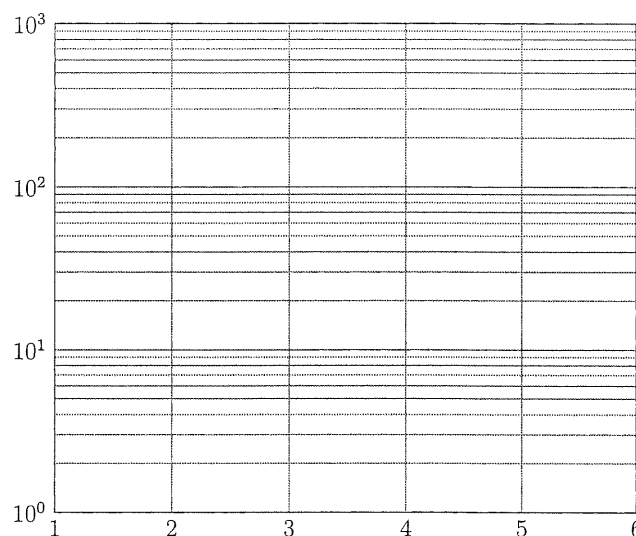
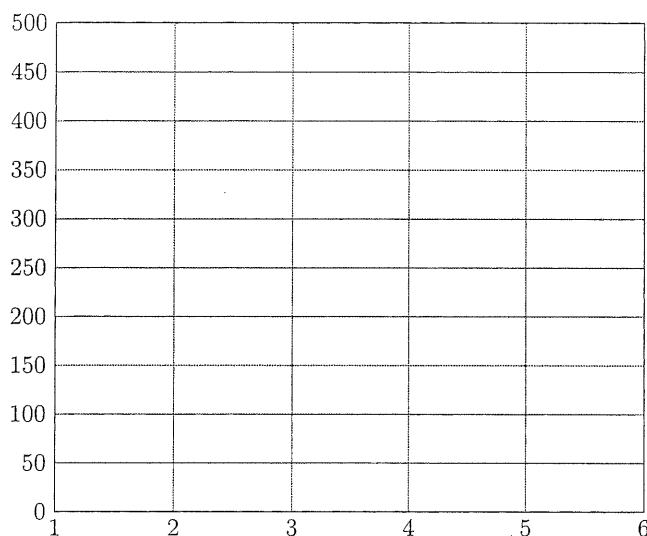
2. (5 marks) The change in elevation between two points is 10m. An instrument is adjusted to a height of 0.95m and its target is adjusted to a height of 1.1m. The distance measured between the points A and B from the instrument to the target is 23.4m. Compute, in DMS, the vertical angle θ from point A to B. **The drawing is NOT to scale**



3. (10 marks) The table below summarizes data collected during an experiment.

sample	A	B	C	D	E	F
x	1	2	3	4	5	6
y	5.7	12.5	30.2	75	165	457

- (a) Use the grids below to plot the data using two different scales. For each graph, draw an approximate curve that best fits the data.

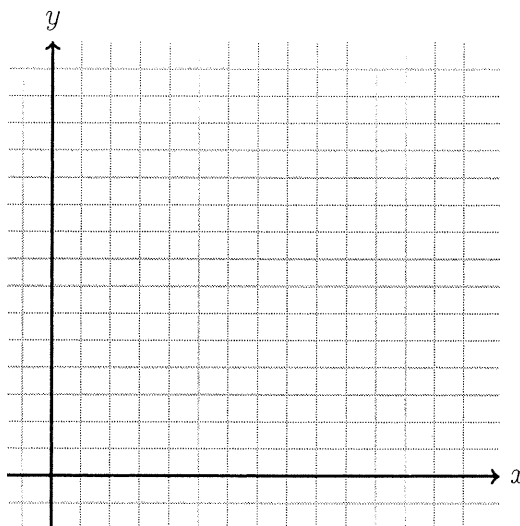


- (b) What type of relationship between the variables does the data suggest? Explain.
- (c) Determine the function that describes the model.
- (d) Using the function that you have found in (c), estimate the value of x when $y = 200$. Check your answer by plotting the point on both graphs.

4. (7 marks) The variable y is measured while varying x . The following variables are presented in the table below:

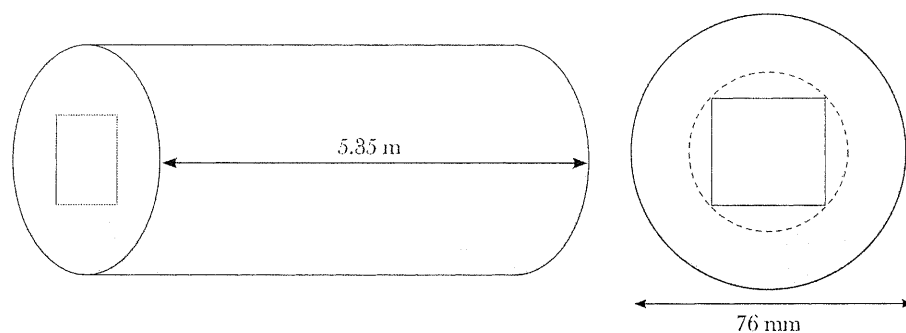
x	0.5	1.0	1.5	2.0	2.5	3.0
y	7.2	3.52	2.43	1.76	1.43	1.21

- (a) Represent the situation graphically by plotting the data points. What mathematical model for the data does the graph suggest? **Make sure to properly label your axes and use appropriate scaling.**



- (b) Confirm the relationship between the variables using an algebraic criterium.
(c) Determine the function that describes the model.
(d) Using the function that you have found in (c), determine the value of y when $x = 4$. Is this an example of interpolation or extrapolation?

5. (7 marks) Compute the volume of the following cylindrical steel beam that has been hollowed out in order to reduce its mass. The cross section shows that the hollow area is in the shape of a square which is inscribed in a circle of diameter 44mm.



6. (6 marks) Using the following excavation survey, determine the volume of earth that must be removed knowing that the lot is partitioned in 12m by 12m squares. **Draw the grid before estimating.**

vertex	height at vertex (m)	# prisms touched	calculations (optional)
<i>a1</i>	10.2		
<i>a2</i>	11.60		
<i>a3</i>	9.8		
<i>a4</i>	10.2		
<i>b1</i>	13.1		
<i>b2</i>	11.1		
<i>b3</i>	10		
<i>b4</i>	8.6		
<i>b5</i>	9.5		
<i>c2</i>	13.7		
<i>c3</i>	12.1		
<i>c4</i>	11.0		
<i>c5</i>	9.9		
<i>d2</i>	13		
<i>d3</i>	7.8		

7. (7 marks) A sample of an aggregate has a wet mass of 147 kg.
- (a.) Compute m_{dry} given that the aggregate has a water content of 8.26%.
 - (b.) Compute m_{water} , the mass of the water contained in the aggregate.
 - (c.) Given that the aggregate has an absorption rate of 0.82 %, compute the mass of the water absorbed by the aggregate.
 - (d.) Compute the free moisture (unabsorbed water) contained in the aggregate.
 - (e.) Compute the moisture content of the aggregate.

Definitions

- $m_{\text{water}} = m_{\text{wet}} - m_{\text{dry}}$
- Water content = $\frac{m_{\text{water}}}{m_{\text{dry}}} \times 100\%$
- Absorption rate = $\frac{m_{\text{water}}(\text{in SSD})}{m_{\text{dry}}} \times 100\%$
- Moisture content: $\frac{m_{\text{unabsorbed water}}}{m_{\text{dry}}} \times 100\%$

8. (6 marks) Perform the following conversions:

(a.) 1.578m^2 to cm^2

(b.) 579.4 ft^3 to m^3

(c.) The area of a $1850\text{ m} \times 600\text{ m}$ field in acres

Selected Conversion factors: $1\text{ft} = 0.3048\text{m}$, $1\text{ acre} = 4840\text{ yds}^2$, $1\text{ yd} = 3\text{ft}$

9. (4 marks) A regular pyramid has a height of 7cm and a volume of 110 cm^3 . Find the height of a **similar** regular pyramaic whose volume is 2970 cm^3 .
10. (5 marks) How many mL of water must be added to a 50L of a 15 % saline solution to make a solution that has 10 % salt.

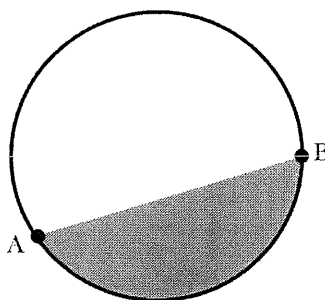
11. (2 marks) Determine the number of significant digits in each approximate number.
- a. 0.00126
 - b. 12.001
 - c. 1000
 - d. 1.00
12. (2 marks) Round each number to three significant digits:
- a. 5784
 - b. 53.555
 - c. 1.418
 - d. 0.02745
13. (2 marks) Round each number to the degree of precision indicated:
- a. 150.256 to the nearest tenth
 - b. 318.050 to the nearest ten
 - c. 0.00275402 to the nearest thousandth
 - d. 27501 to the nearest thousand
14. (5 marks) Determine the coordinates of the points of intersection (if they exist) of the following pairs of functions:

$$f(x) = 5x + 1 \text{ and } g(x) = 3x^2 - x + 1$$

15. (4 marks) Complete the following table:

measurement	decimal notation	scientific notation	engineering notation
$3256 \times 10^2 \text{ m}$			
$0.035 \times 10^{-5} \text{ g}$			
$0.22 \times 10^8 \text{ L}$			

16. (5 marks) A circle has a radius of 6cm. Compute the area of a segment of the circle bounded by the chord AB (shaded area) given that the length of the corresponding arc is 10cm.



17. (12 marks) Solve the following equations. Show all of your work.

(a.) $5(1 - 2^x) = 3$

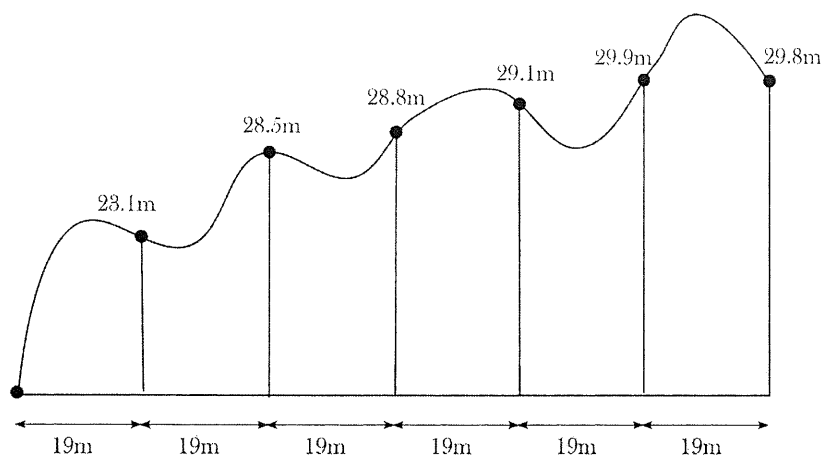
(b.) $\log_2\left(\frac{x}{5}\right) = 3$

(c.) $\sin \alpha = -0.45$ where $\theta \in [0^\circ, 360^\circ]$

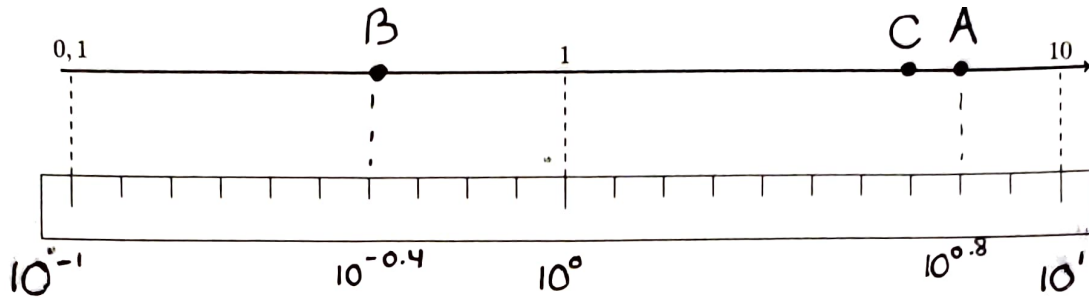
(d.) $\frac{1}{\frac{1}{1000} + \frac{1}{x}} = 375$

18. (6 marks) Using the measurements indicated on the following sketch, approximate the area of the surface using:

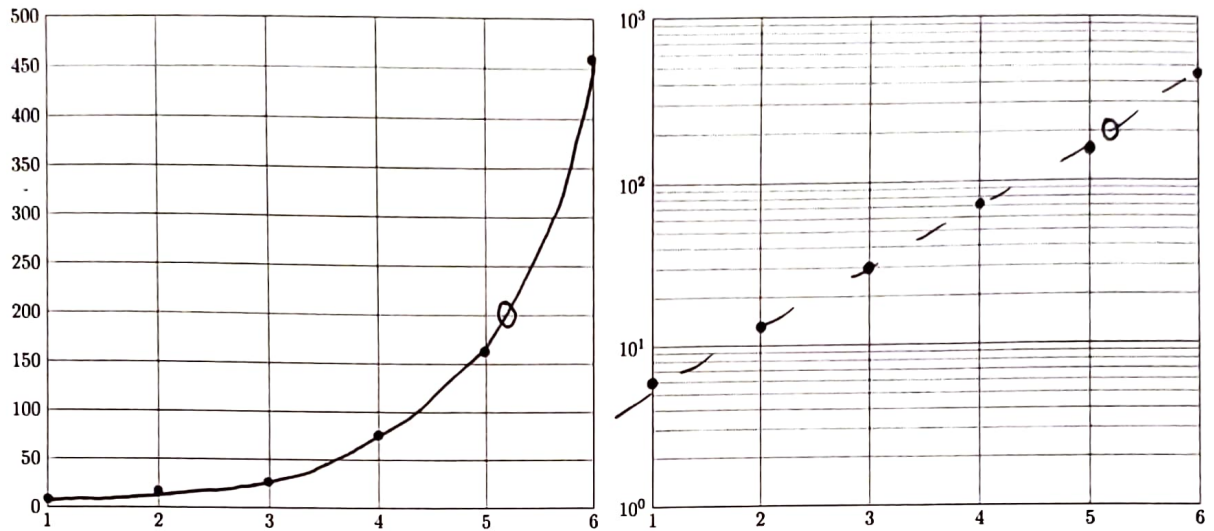
- (a.) the Trapezoidal Method
- (b.) Simpson's Method



Answers:



- 1.
2. $\theta = 64.3^\circ$
3. A.



b. Exponential: on a linear scale it appears exponential, on semi-log scale it appears linear.

c. $y = ab^x$; $Y = \log y = 0.3793x + 0.353$

d. $x = 5.14$

4. a.

b. $xy = a$; c. $y = \frac{a}{x} = \frac{3.58}{x}$ d. $y = \frac{3.58}{4} = 0.895$ extrapolation

5. $V = 0.01909 \text{ m}^3$

6. $V = 10.8468 \text{ m}^3$

7. a. 135.78 kg ; b. 11.22 kg ; c. 1.113 kg ; d. 10.107 kg ; e. 7.44%

8. a. 15780 cm^2 ; b. 16.41 m^3 ; c. 274.29 acres

9. $h = 21$

10. 25000 ml

11. a. 3; b. 5; c. 1; d. 3

12. a. 578; b. 53.6; c. 1.42; d. 0.0274

13. a. 150.3; b. 320; c. 0.003; d. 28000

14. (0,1); (2,11)

15.

measurement	decimal notation	scientific notation	engineering notation
$3256 \times 10^2 \text{ m}$	32560	3.256×10^5	325.6×10^3
$0.035 \times 10^{-5} \text{ g}$	0.00000035	3.5×10^{-7}	350×10^{-9}
$0.22 \times 10^8 \text{ L}$	22000000	2.2×10^8	22×10^6

16. $A = 12.08m^2$

17. $a. -1.32$; $b. 40$; $c. \alpha = 206.74^\circ, \alpha = 333.26^\circ$; $d. x = 600$

18. $a. 2931.7 m^2$; $b. 2990.6m^2$