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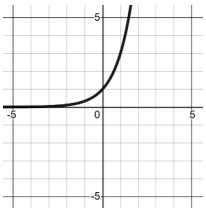
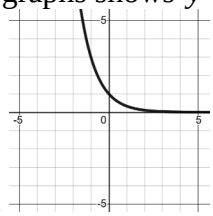
Test #1 – Exponential and Logarithmic Functions

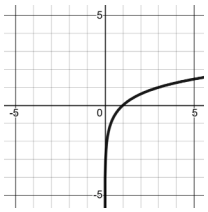
[40 marks]

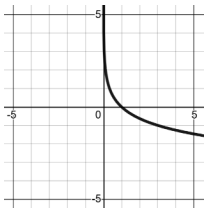
Part A: Multiple Choice [K/U, 10 marks]

1. Which of the following graphs shows $y=3^x$?

a. 

b. 

c. 

d. 

2. A ball of dough has an initial volume of 250mL and is doubling in volume every hour. An equation that models the volume (V) of the dough after *t* hours is...
   a. $y=2(250)^t$ b. $y=250(2)^t$ c. $y=1.02(250)^t$ d. $y=250(1.02)^t$

3. The average value of a condominium in Toronto is decreasing by 2.4% per year. What is the decay factor (*b*)?
   a. -0.024 b. 0.024 c. 0.976 d. 1.024

4. $27^{\frac{2}{3}}$ = ...
   a. $\sqrt[3]{27^2}$ b. $\left(\sqrt[3]{27}\right)^2$ c. 9 d. All of the above

5. When simplified, the expression $4a^2b^3 \div 2a^3b^2$ becomes...
   a. $8a^5b^5$ b. $2ab$ c. $\frac{8b}{a}$ d. $\frac{2a}{b}$

6. The solution to $5^{x-3}=25$ is...
   a. $x = 8$ b. $x = 5$ c. $x = -\frac{2}{3}$ d. There is no solution

7. What is the **range** of the function $y = \log_{\frac{1}{2}} x$?
   a. $\{y \in R\}$ b. $\{y<0, y \in R\}$ c. $\{y>0, y \in R\}$ d. $\{y \neq 0, y \in R\}$

8. The expression $2^6 = 64$ is equivalent to...
   a. $\log_2 6 = 64$ b. $\log_2 64 = 6$ c. $\log_6 2 = 64$ d. $\log_{64} 2 = 6$

9. The hydronium concentration in an acid is 0.0001 mol/L. What is its pH? $[\text{pH} = -\log[H^+]]$
   a. -2 b. -3 c. -4 d. -5

10. Which of the following equations shows a doubling time of 5 hours?
    a. $y=75(5)^{2t}$ b. $y=75(5)^{\frac{t}{2}}$ c. $y=75(2)^{5t}$ d. $y=75(2)^{\frac{t}{5}}$

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Part B: Definition / Short Answer [C, 10 marks]

1. What do the *a* and *b* represent in the equation $y=a(b)^x$? [2]

2. Given $y=b^x$ or $y=\log_b x$, how can you determine if the graph will be increasing or decreasing from left to right? [2]

3. When asked to evaluate $\log_2 32768$, what are you be asked to determine? [2]

4. Describe **two** ways you could solve an equation such as $4^{x+1}=8^x$. [2]

5. Explain how to evaluate $\log_2 10$ on your calculator using the [log] or [ln] button. [2]

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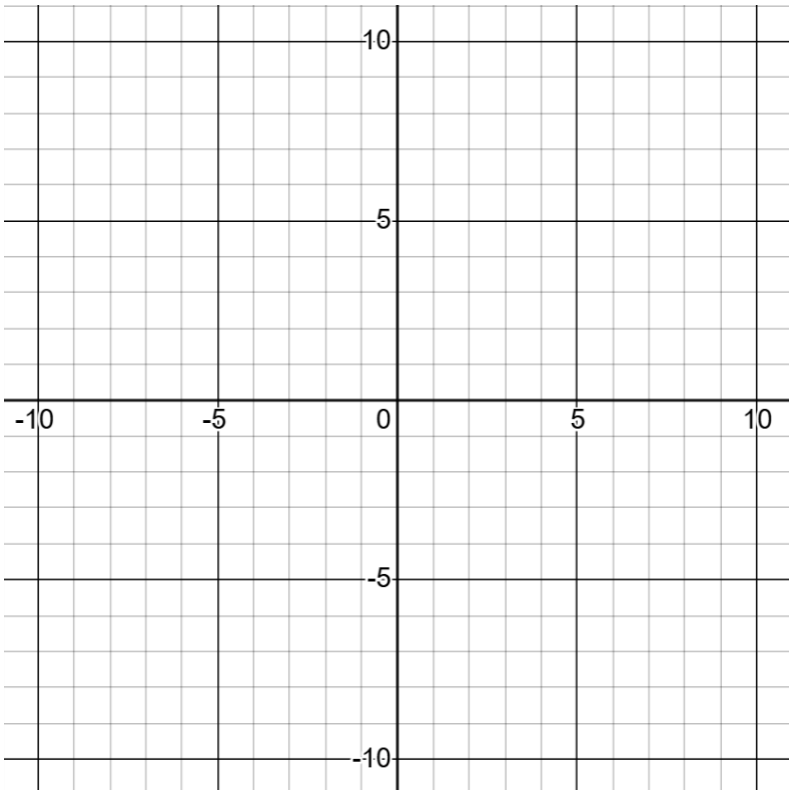
Part C: Problem Solving [ATIPS, 20 marks]

Complete any 5 of the following 6 problems. If you complete all 6, you will get marks for the "best 5".

1. Create tables of values and sketch the graphs of $y=\frac{1}{2}^{x}$ and $y=\log_{\frac{1}{2}} x$ on the grid provided. [4]



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2. Solve the following equations for *x*:

a. $6^{4x+1}=36^{3x-5}$

b. $\sqrt{8}=\left(\frac{1}{2}\right)^{x+2}$

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3. The population of Collingwood for the past five years is shown in the table below.

Year	Population
2021	24800
2022	25445
2023	26106
2024	26785
2025	27482

a. Determine the annual growth rate of Collingwood's population. [2]

b. Predict the population of Collingwood in the year 2050. [2]

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4. Solve for x.

a. $8^x = 25$

b. $3^{2x-1} = 5^{x+1}$

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5. The decibel scale, used to measure sound intensity, is modelled by

$$\beta_2 - \beta_1 = 10 \log\left(\frac{I_2}{I_1}\right)$$

where β are the magnitudes (in decibels) and *I* are the sound intensities (energies)./

a. How many times louder is a rock concert (120dB) than a normal conversation (50dB)? [2]

b. The sound of rustling leaves registers at 35dB. What decibel level is a sound that is 3000 times louder? [2]

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6. A bicycle tire has a slow leak. It starts at 33 PSI, and is losing 2% per day.

   a. Create a model for the remaining pressure in terms of the number of days. [1]

   b. The tire will be unusuable if the pressure drops below 24 PSI. How many days will this take to occur? [3]