MAC 1140 FINAL EXAM A NAME ______________________

SHOW ALL WORK ON THIS TEST OR ON SEPARATE PAPER. Circle answers. TURN IN ALL WORKSHEETS. CALCULATORS ARE REQUIRED ON THIS TEST.

1. Calculate each of the following (round to nearest thousandth or give scientific notation):

a) $\dfrac{6.3 \times 10^{23} \cdot 9.5 \times 10^{-4}}{7.5 \times 10^{-12} \cdot 4.3 \times 10^{3}}$ b) $\dfrac{\sqrt[3]{50}}{\sqrt{0.0025}}$ c) $\dfrac{50!}{40!}$

2. Use the graphing calculator to graph each of the following:

a) $Y = 0.1X^4 - X^3 + 2X^2$ b) $Y = X(50 - X)$

3a) Find point(s) of intersection for $Y=X^2-4$ and $Y=12/(X-3)$. Draw the graph.

b) Find point(s) of intersection for $Y=X^2-4$ and $Y=-3/X$. Draw the graph.

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4. The perimeter of a rectangle is 12 meters. If the width is X, then a) express the length and the area in terms of X.

b) After noting the physical constraints X for the problem, sketch the graph of area as a function of X.

c) From the graph, find the dimensions of the rectangle of maximum area.

5. Solve the equation graphically. Sketch the graph.

$$(X+4)^{\frac{1}{2}} + 5X\,(X+4)^{\frac{3}{2}} = 0$$

6. Solve the inequality graphically. Sketch the graph.

$\frac{5-X}{X+3} \geq 0$ (Give interval notation)

7. The velocity of a ball thrown vertically upward is given by $v(t) = -32t + 48$, where t is the time in seconds and v is the velocity in feet per second.

a) Find the velocity when t=1.

b) Find the velocity when t=2.

c) Find the time when the ball reaches maximum height.

8. Find all real or complex zeros of $f(X) = X^4 - X^3 + X^2 - 3X - 6$. Graph.

9a) $(2 - 5i)^3$

b) $\frac{6 - 3i}{2i}$

10. Solve the system:

$$\begin{aligned} 4X + Y - 3Z &= 11 \\ 2X - 3Y + 2Z &= 9 \\ X + Y + Z &= -3 \end{aligned}$$

11 a) $\log_{10} 0.0001 =$ ______

b) $\log_6 16 =$ ______

c) $\log_2 X = 0$

d) $\ln\left(\frac{1}{\sqrt{e}}\right) =$ ______

12. Solve for X:
$40^{(X - 2)} = 6^{(3X - 4)}$

13. The population of a city in 1980 was 20,000. In 1985, the population was 32,000.

a) Assuming that $Y = Y_0 e^{kt}$, find the value of k.

b) Use this value of k to predict the population of the city in 1995.

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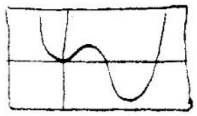
DISCLAIMER: These are only "solutions", certainly not the only solutions, nor even the best solutions. Always look for better ways to solve problems.

1a) 1.856×10^{28}

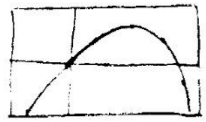
b) 73.681

c) 3.728×10^{16}

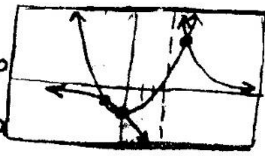
2a. x: −10 to 10, y: −15 to 15



2b) x: −10 to 60, y: −500 to 700

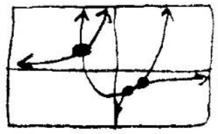


3a) x: −20 to 20, y: −20 to 20



(−1, 3)
(0, −4)
(4, 12)

3b) x: −10 to 10, y: −10 to 10



(−2.303, 1.303)
(1, −3)
(1.303, −2.303)

4a) x = width. b) Constraint: $0 < x < 6$

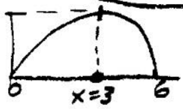
$2x + 2y = 12$

$x + y = 6$

$L = y = 6 - x$

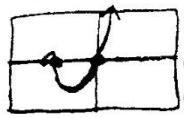
$A = xy$

$A = x(6 - x)$



c) Maximum area $= 3 \times 3 = 9\,m^2$

5. Be careful: There are 3 points.



$(x+4)^{1/2} + 5x(x+4)^{3/2} = 0$

$(x+4)^{1/2}\left[1 + 5x(x+4)\right] = 0$

$(x+4)^{1/2}\left[5x^2 + 20x + 4\right] = 0$

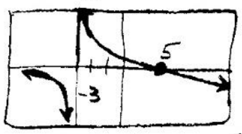
$x = -4$ QUAD. FORMULA

$x = -3.949$

$x = -0.506$

6. $\frac{5-x}{x+3} \geq 0$ Above x axis

Endpts: $x = 5$, $x \neq 3$



$(-3, 5]$

7a) $v(t) = -32t + 48$

$v(1) = -32 + 48 = 16$

b) $v(2) = -64 + 48 = -16$

c) Max height ($v = 0$)

$0 = -32t + 48$

$32t = 48$ $t = 1.5$ sec

8. Use POLY: $x = -1, 2, \pm\sqrt{3}\,i$

Also: $x^4 - x^3 + x^2 - 3x - 6 = 0$

2	1	−1	1	−3	−6
	↓	2	2	6	6
−1	1	1	3	3	0
	↓	−1	0	−3	
	1	0	3	0	

$x^2 + 3 = 0$ ($x = 2, -1$)

$x^2 = -3$ $x = \pm 3i$

9a) $(2 - 5i)^3$

Calculator

$(2, -5) \wedge 3$

$-142 + 65i$

b) $(6, -3) \div (0, 2)$

$= -1.5 - 3i$

11a) −4 b) $\frac{\ln 16}{\ln 6} = 1.5474$

c) $\log_2 x = 0$

$2^0 = x = 1$

d) $\ln\left(\frac{1}{\sqrt{e}}\right) = \ln e^{-1/2} = -\frac{1}{2}$

10. $D = \begin{vmatrix} 4 & 1 & -3 \\ 2 & -3 & 2 \\ 1 & 1 & 1 \end{vmatrix} = -35$ $z_n = \begin{vmatrix} 4 & 1 & 11 \\ 2 & -3 & 9 \\ 1 & 1 & -3 \end{vmatrix} = 70$

$x_n = \begin{vmatrix} 11 & 1 & -3 \\ 9 & -3 & 2 \\ -3 & 1 & 1 \end{vmatrix} = -70$ $x = \frac{-70}{-35} = 2$

$y = \frac{105}{-35} = -3$

$y_n = \begin{vmatrix} 4 & 11 & -3 \\ 2 & 9 & 2 \\ 1 & -3 & 1 \end{vmatrix} = 105$ $z = \frac{70}{-35} = -2$

12. $40^{(x-2)} = 6^{(3x-4)}$

take ln both sides or

$y = 40^{(x-2)} - 6^{(3x-4)}$

ROOT $x = -0.125$

13. $y = y_0 e^{kt}$

$\frac{32000}{20000} = \frac{20000e^{5t}}{20000}$

$\ln 1.6 = \ln e^{5k}$

$5k = \ln 1.6$

$k = \frac{1}{5}\ln 1.6$

$k \approx 0.094007258$

$y = 20{,}000\, e^{(k)(15)}$

$= 81{,}920$