

You should complete all of your work neatly on a separate sheet of paper. Make sure to label each problem and box in your answers.

I. Calculator Basics

- Find the largest and smallest values of each of the following functions on their given x intervals.
 - $f(x) = 2^x + x^2$ on $[-4, 1]$
 - $y = (\cos x)^x$ on $[-1.5, 4.75]$
 - $f(x) = \frac{3x^2 + x - 5}{x^2 + 1}$ on $[2, 4]$
 - $g(x) = \frac{1}{\sqrt{4 - x^2}}$ on $(-2, 2)$
- Graph $y = \frac{x^2 - 9}{x - 3}$ on your calculator.
 - Explain why this graph appears to be a linear function, rather than a curve with a vertical asymptote at $x = 3$.
 - Explain what is happening to the function at $x = 3$.
 - IF you had to fill in a y -value when $x = 3$, what would it be?
- An open box is to be made from cutting squares of side length s from each corner of a piece of cardboard 25" by 30".
 - Write an expression for the volume, V , of the box in terms of s .
 - Graph $V(s)$ using your calculator. Identify a reasonable domain and range for this graph in the context of this problem.
 - Find the value of s that will give the maximum volume of the box.
 - What value(s) of s will give a volume of 1225 cubic inches?

II. Cartesian Plane Basics

- Determine the slope, length and midpoint of the line segment with endpoints $(1, -2)$ and $(3, 2)$.
- For what value(s) of k is $5x + ky = 3$ parallel to $2x - 3y = 5$? For what value(s) of k are the two lines perpendicular?
- Plot the line $2x - 5y = 10$ indicating your x and y -intercepts. Be sure to label your axes to indicate your scale.
- Find the minimum distance from point $P(1, 2)$ to the line $x + 2y = 3$.

8. Suppose you want to rent a jet for one day. Swisair rents jets with a pilot for \$2000 per day plus \$1.75 per mile and Air France rents jets with a pilot for \$1500 per day plus \$2.00 per mile.
- For each company, write an equation for the cost as a function of distance traveled.
 - If cost were the only consideration, which company would you choose.
9. Find the line that passes through the point $(-1, 3)$ and the point of intersection of the lines $x + 3y = 1$ and $2x - y = -5$. Write your answer in point slope form $(y - y_1 = m(x - x_1))$.

III. Basic Functions and Transformations

10. You should be very familiar with the following functions and be able to envision them in your mind without having a graph.

- Constant Function: $f(x) = C$, where C is a constant
- Linear Functions: $f(x) = mx + b$
- Quadratic Function: $f(x) = ax^2 + bx + c$
- Polynomial Function: $f(x) = ax^n + bx^{n-1} + \dots + mx + n$
- Rational Function: $f(x) = \frac{P(x)}{Q(x)}$, where $P(x)$ and $Q(x)$ are polynomials
- Radical Functions: $f(x) = \sqrt{x}$ and $f(x) = \sqrt[3]{x}$
- Exponential Function: $f(x) = e^x$, Know the domain and range.
- Natural Log Function: $f(x) = \ln x$, Know the domain and range.
- Absolute Value Function: $f(x) = |x|$

11. Using transformations, describe how the graph of each function can be obtained from the graph of

$$f(x) = \sqrt{x} \quad g(x) = \frac{1}{x} \quad h(x) = |x| \quad k(x) = x^3 \quad l(x) = \ln x \quad \text{OR } m(x) = e^x$$

- $y = .5(x - 4)^3 + 2$
- $y = |x + 2| - 1$
- $y = -\sqrt{3 - x} + 4$
- $y = 2 \ln(x + 3) - 3$
- $y = e^{x-1} - 3$

12. Remember that for even functions, $f(-x) = f(x)$ and that for odd functions, $f(-x) = -f(x)$, show whether the following functions are even, odd or neither.

- $y = x^4$
- $y = x - x^4$
- $y = \frac{1}{x^2 - 4}$
- $y = -2x^3 + 4x$

IV. Trig Review

You should know the Unit Circle, basic shapes of the sine, cosine, and tangent functions, their domains and ranges and the following trig identities:

$$\sin^2 \theta + \cos^2 \theta = 1$$

$$\sin 2x = 2 \sin x \cos x$$

13. You **MUST** be able to evaluate the following **WITHOUT** a calculator. We always use radians, not degrees.

a) $\sin \pi$

b) $\cos \frac{3\pi}{2}$

c) $\tan \frac{5\pi}{4}$

d) $\sin \frac{4\pi}{3}$

e) $\cos \frac{7\pi}{4}$

f) $\sin \frac{2\pi}{3}$

g) $\tan \frac{5\pi}{6}$

h) $\sin \frac{11\pi}{6}$

14. Convert the following to radians:

a) 510°

b) 120°

c) 135°

d) -210°

15. Identify which of the six trig functions are a) even, b) odd, c) neither.

16. Which of the following have the same graph?

a) $y = \sin(x)$

b) $y = -\sin(x)$

c) $y = \cos(x)$

d) $y = \sin(-x)$

e) $y = -\cos(x)$

17. Consider the function $y = \sqrt{\frac{1+\cos 2x}{2}}$

a) Can x take on any real value?

b) How large can $\cos 2x$ become? How small?

c) How large can $\frac{1+\cos 2x}{2}$ become? How small?

d) What are the domain and range of the original function?

18. Solve each of the following on the interval $[0, 2\pi)$.

a) $2 \sin x - \sqrt{3} = 0$

b) $\cos^2 x = 2 \sin x - 2$

19. Solve each of the following on the interval $[0, 2\pi)$.

a) $\sin^2 x < 2 \cos x + 1$

b) $2 \sin x \cos x + \sqrt{2} \cos x < 0$

V. Exponents, Radicals and Factoring

20. Simplify each of the following expressions.

a) $\left(\frac{2}{3}x^{-3}\right)(15x^7)$

b) $x^3(2yz^2)^3$

c) $\frac{(3x^3)(4x^5)}{(x^2)^3}$

d) $\frac{(2y^4)(3y^2)^2}{(y^3)^4}$

e) $(3a^{-2}b^3)^{-3}$

21. Simplify the following by removing all possible factors from the radical.

a) $\sqrt{9z^8b}$

b) $\sqrt{24a^4b^8}$

c) $\sqrt{\frac{75}{a^6}}$

22. Factor each of the following completely.

a) $6x^3y^2 + 15x^2y^5 - 30x^7y^4z$

b) $16y^2 - 9$

c) $4x^{16} - 9y^6$

d) $6x^2 + 7x - 20$

e) $3x^2 - 5x + 2$

f) $x^3 - x^2 + 3x - 3$

g) $3a^3 + 3a^2 - 27a - 27$

h) $x^2 + 4x + 4 - 9y^2$