Note: You may detach this reference sheet for use during the exam.

[Unit Circle Image Placeholder]

Pythagorean Trig Identities

1. $\sin^2(x) + \cos^2(x) = 1$
2. $1 + \cot^2(x) = \csc^2(x)$
3. $\tan^2(x) + 1 = \sec^2(x)$

Sum and Difference Formulas

1. $\sin(u \pm v) = \sin u \cos v \pm \cos u \sin v$
2. $\cos(u \pm v) = \cos u \cos v \mp \sin u \sin v$
3. $\tan(u \pm v) = \frac{\tan u \pm \tan v}{1 \mp \tan u \tan v}$

Law of Sines

- $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

Law of Cosines

- $a^2 = b^2 + c^2 - 2bc \cos A$
- $b^2 = a^2 + c^2 - 2ac \cos B$
- $c^2 = a^2 + b^2 - 2ab \cos C$

1. Simplify each expression.

   a) $(2x)^{-3}(2x^2z^0)^4$

   b) $\left(\frac{4}{x}\right)^3\left(\frac{2}{y}\right)^{-3}$

2. Find the domain of the given function.

   $f(x) = \dfrac{\sqrt{x-8}}{x-10}$

   $g(x) = x^2 - 12x + 31$

3. Write an equation of the line that has the given characteristics.

   a) Passes through points $(2, 5)$ and $(-4, 8)$

   b) Passes through points $(6, 1)$ and $(6, -9)$

c) Parallel to $y = \frac{2}{3}x - 4$ and passes through the point $(4, -1)$

4. Use these functions for the following questions:

$$f(x) = 2x + 5 \quad \text{and} \quad g(x) = x^2 + 4x - 2$$

a) Find the function $f \circ f$

b) Find the function $g \circ f$

5. Find the inverse function of f.

$$f(x) = \frac{7}{x^3 + 2}$$

6. Find all solutions.

a) $2x^2 - 5x - 12 = 0$

b) $x^3 - 10x^2 + 21x = 0$

7. Write the expression below as the logarithm base c of a single number.

$$\log_c(12) - \frac{1}{2}\log_c(16) + 3\log_c(2)$$

8. Find the solution. Round to two decimal places. (Solve for the variable first, *then* use a calculator)

   a) $e^{4x} = 85$

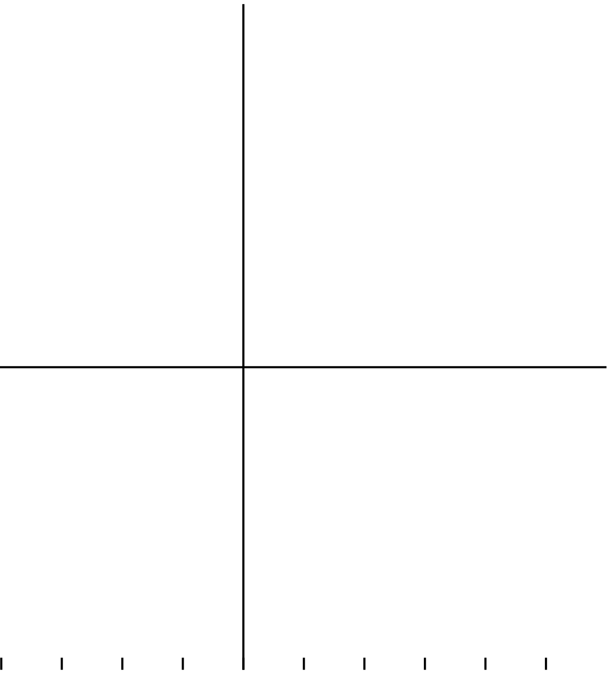
   b) $3^{5x} = 42$

   c) $e^{2x-5} = 2(e^{2x-5} - 7)$

   d) $\log_6(x) + \log_6(x+1) = \log_6(12)$

9. Graph the functions $y = a^x$ and $y = \log_a x$ on the same graph ($a > 1$). Label any intercepts and give the domain and range of both.

	$y = a^x$	$y = \log_a x$
Domain		
Range		
Intercepts		



10. Modeling

a) The number N of bacteria in a culture follows the model $N = Ae^{kt}$. If the initial population A is 120 and 4 hours later $N = 350$, when will $N = 2000$? Round to two decimal places.

b) The population p of a species of fish t years after introduction is:

$$p = \frac{3000}{1 + 4e^{-t/2}}$$

1) Determine the initial population size.

2) After how many years will the population be 2500?

11. Evaluate the following expressions in exact form.

    a) $\cos\pi =$

    b) $\sin\frac{5\pi}{4} =$

    c) $\sin^{-1}(-\frac{1}{2}) =$

    d) $\cos^{-1}(-\frac{\sqrt{2}}{2}) =$

12. Solve for all possible triangles: $A = 42°$, $B = 95°$, $c = 12$. Round to two decimal places.

13. Rewrite as an algebraic expression of x:

$$\sin(\cos^{-1}(x))$$

14. Find all solutions.

    a) $2\cos(4x) + \sqrt{3} = 0$

    b) $2\cos^2(x) - \cos(x) = 0$

15. Points P and Q are separated by a forest. To find the distance between them, a surveyor locates point R such that angle R is 125°, the distance from P to R is 210 meters, and the distance from Q to R is 150 meters. Draw a picture and find the distance PQ to the nearest meter.

16. A forest ranger in a tower 150 feet high observes two fires in a straight line from the tower. The angles of depression to the fires are 12° and 28°. Draw a picture and find the distance between the two fires to the nearest foot.

17. Match the equation to the graph. (Assume graphs A-F are provided as in Version A).

i) $y = 2\cos(x) - 1$

ii) $y = 3\sin(2x)$

iii) $y = \cos(4x)$

iv) $y = 2\cos(x) + 1$

v) $y = 3\sin(-2x)$

vi) $y = \cos(\frac{1}{4}x)$