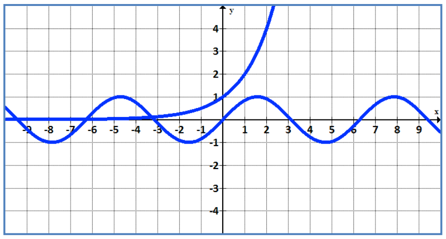
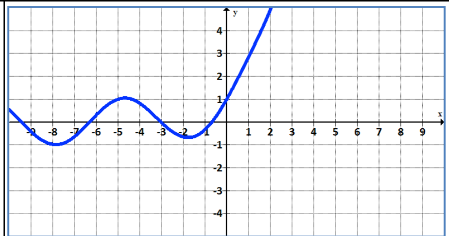
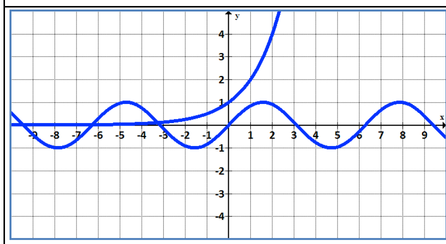
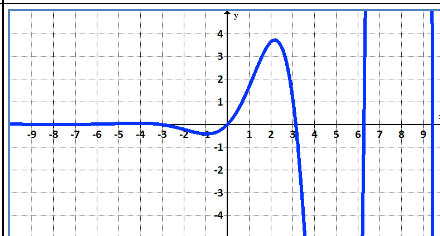
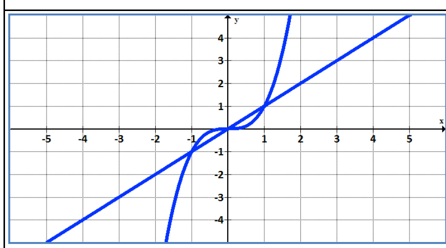
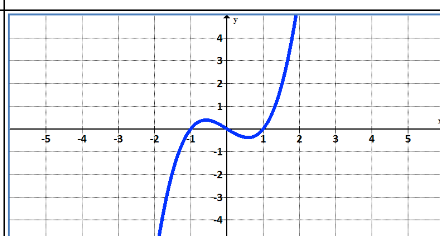
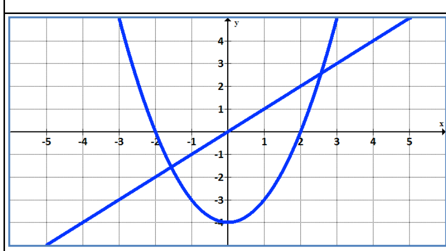
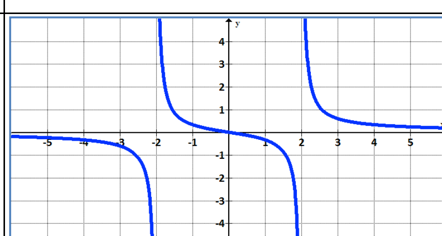
7.1 Combinations of Functions

Original Functions	Combination	Key Features
 1. $\sin x$ & 2^x	 $\sin x + 2^x$	• periodic suggests sine or cosine • dramatic change for positive x-values, not existing for negative x-values, suggests exponential • y-intercept for 1 can be obtained by adding the y-intercepts of each of the original graphs, only addition will produce this
 1. $\sin x$ & 2^x	 $2^x \cdot \sin x$	• periodic suggests sine or cosine • dramatic change for positive x-values, not existing for negative x-values, suggests exponential • x-intercepts correspond to the x-intercepts of the sine function therefore multiplication or division • division by exponential would result in small y-values in first and fourth quadrant, division by sinusoidal would result in asymptotes, therefore must be multiplication
 2. x^3 & x	 J. $x^3 - x$	• difference of odd functions is an odd function • cannot be multiplication since odd X odd is even • general motion is cubic, result is cubic • (0,0) is a point on both originals and combination • cannot be division since no asymptote occurs • x-intercepts occur where the graphs intercept, implying subtraction
 3. x & $x^2 - 4$	 P. $\dfrac{x}{\left(x^2 - 4\right)}$	• asymptotes at 2 and -2 suggests division by x^2 - 4 • division results in y-values of 1 on the combined graph for values of x where the original graphs intersect • when 0 < y < 1 y-values of the combined graph becomes large, and when -1 < y< 0 the y-values of the combined graph becomes small • (0,0) is a point on the combined graph giving information about the numerator • odd function divided by an even function is an odd function

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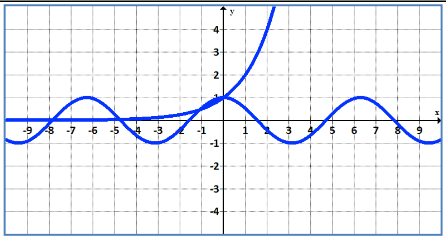
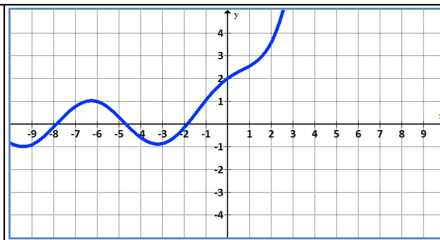
<td>
4. 2^x & $\cos x$</td>
<td>
E. $2^x + \cos x$</td>
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periodic suggest sine of cosine
dramatic change for positive x-values, not existing for negative x-values, suggests exponential
y-intercept of 2 can be obtained by adding the y-intercept of 1 of each of the original graphs, only addition will produce this result

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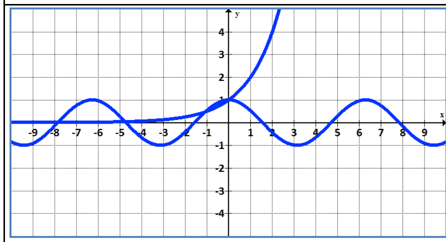
<td>
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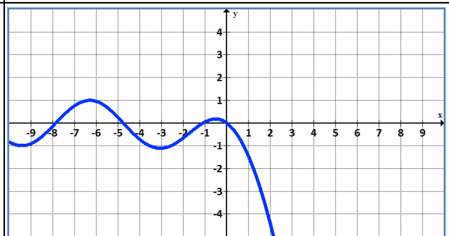
<td>
S. $\cos x - 2^x$</td>
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periodic suggests sine or cosine
dramatic change for positive x-values, not existing for negative x-values, suggests exponential
y-intercept of 0 can be obtained by subtracting the y-intercept of 1 for each of the original graphs
x-intercepts are where the original graphs intersect, implying subtraction
as x-increases, the combination decreases quickly, suggesting subtraction of an exponential

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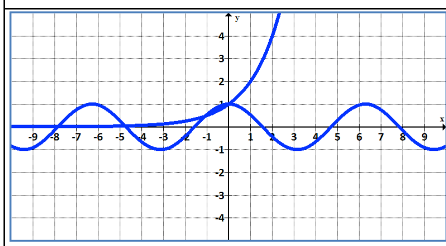
<td>
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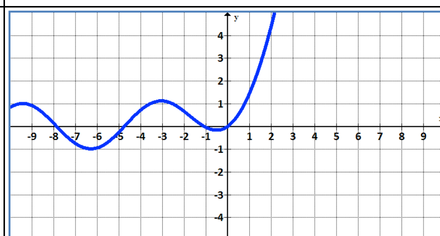
<td>
G. $2^x - \cos x$</td>
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periodic suggests sine or cosine
dramatic change for positive values, not existing for negative x-values, suggests exponential
y-intercept of 0 can be obtained by subtracting the y-intercept of 1 of each of the original graphs
x-intercepts are where the original graphs intersect, implying subtracting
as x-increases, the combination increases quickly, suggesting subtraction of the periodic from the exponential

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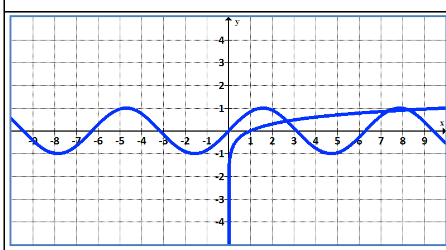
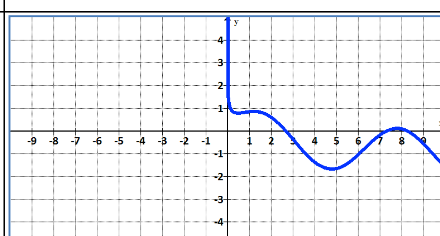
<td>
5. $\sin x$ & $\log x$</td>
<td>
H. $\sin x - \log x$</td>
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periodic suggests sine or cosine function
domain >0 suggests log function
decreasing sinx graph suggests something is being "taken away", thus subtraction
x-intercepts are where the original graphs intersect implying subtraction
when log is very small (or large negative), the combined graph becomes very large, implying subtraction from the log values

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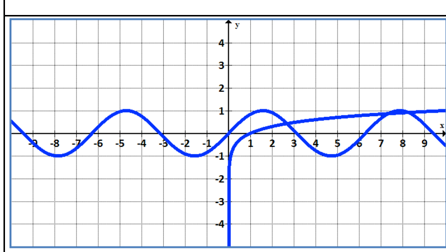
<td>
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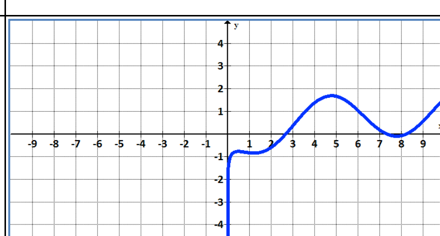
<td>
M. $\log x - \sin x$</td>
<td>

periodic suggests sine or cosine function
domain >0 suggests log function
x-intercepts are where the original graphs intersect implying subtraction
when log is very small, the combined graph remains small, implying subtraction from the log

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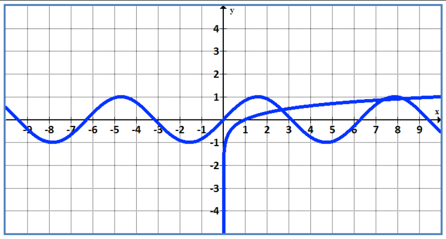
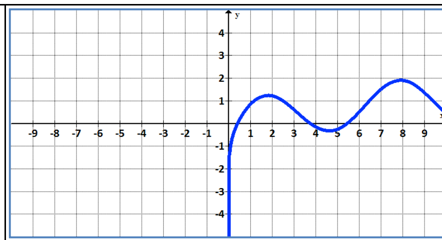
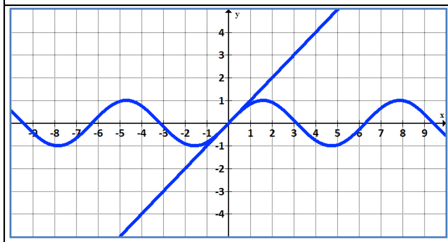
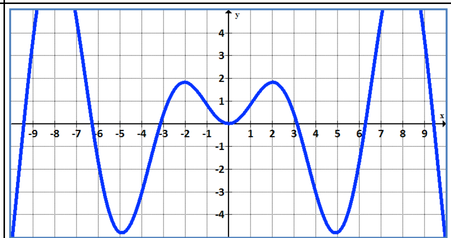
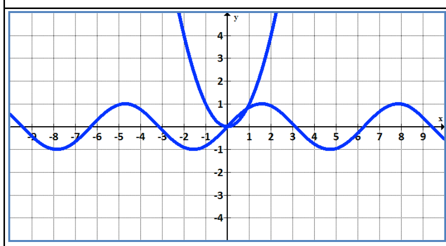
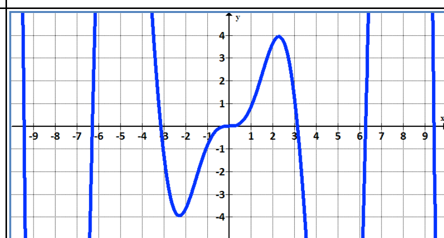
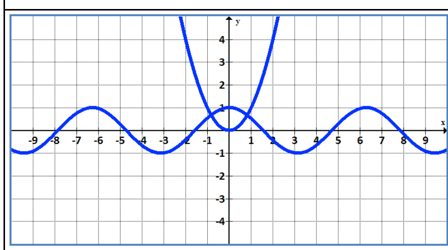
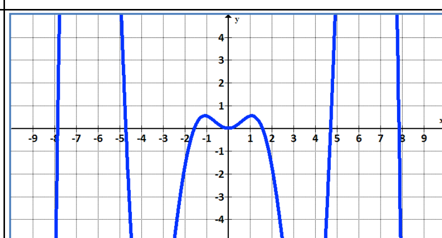
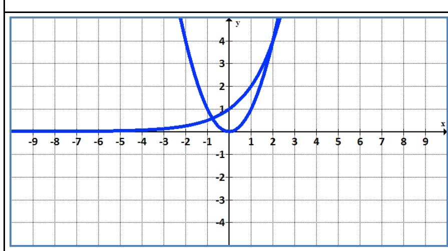
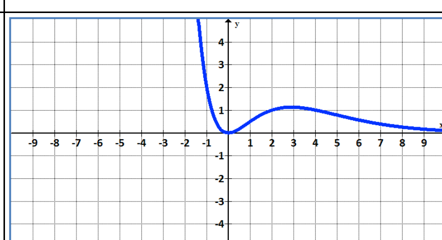
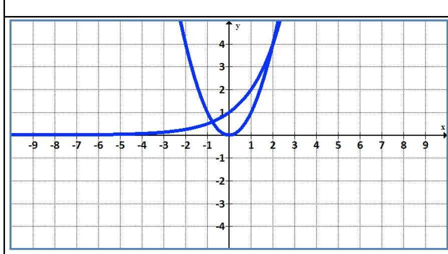
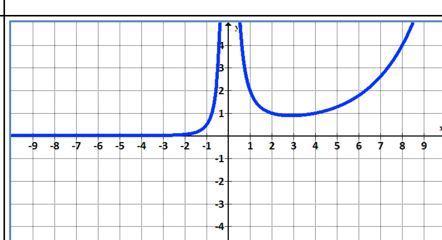
 5. $\sin x$ & $\log x$	 T. $\log x + \sin x$	• periodic suggests sine or cosine function • domain >0 suggests log function • when log is very small, the combined graph remains small, implying log is not being subtracted • the sine curve is increasing, implying something is being added to the sine
 6. x & $\sin x$	 F. $x(\sin x)$	• periodic suggests sine or cosine function • x-intercepts exist wherever there is an x-intercept in either of the original functions, suggesting multiplication • odd function multiplied by an odd function, results in an even function
 7. x^2 & $\sin x$	 R. $x^2(\sin x)$	• periodic suggests sine or cosine function • x-intercepts exist wherever there is an x-intercept in either of the original functions, suggesting multiplication • even function multiplied by an odd function, results in an odd function
 8. x^2 & $\cos x$	 N. $x^2(\cos x)$	• periodic suggests sine or cosine function • x-intercepts exist wherever there is an x-intercept in either of the original functions, suggesting multiplication • even function multiplied by an even function, results in an even function
 9. x^2 & 2^x	 K. $\frac{x^2}{2^x}$	• x-intercept occurs at x-intercepts of x^2 suggesting multiplication or division • where 2^x is small the combined graph is large and vise versa, suggesting division by 2^x • where the graphs intersect at (2,4), division produces the point (2,1)
 9. x^2 & 2^x	 Q. $\frac{2^x}{x^2}$	• asymptote at y-axis suggests division by a function going through the origin • combined function is small as x gets small, and is large as x gets large, suggests exponential