Lecture 33: Half angle formula

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Question 1.

Select a true trigonometric identity.

A $\sin(2t) = 2\sin(t)$

B $\sin^2(t) + \cos^2(t) = \cos(0)$

C $\sin(a+b) = \sin(a)\cos(b) + \sin(b)\cos(a)$

D $\cos(a+b) = \cos(a)\cos(b) - \sin(a)\sin(b)$

E $\tan(x) = \frac{1}{\cot(x)}$

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All but A are identically true. If we let $t = \pi/2$, then $\sin(2t) = 0$, but $2\sin(t) = 2$, thus there is at least one value of t for which this equation fails.

Question 2.

Which of the expressions below is equivalent to $\cos(x - \pi/2)$?

A $\cos(x)$

B $-\cos(x)$

C $\sin(x)$

D $-\sin(x)$

E $\sin(\pi/2 - x)$

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Question 3.

If an angle of measure t and the terminal side of the angle passes through the point $(-42, -24)$, determine the signs of $\cos(t/2)$ and $\sin(t/2)$.

A $\cos(t/2) > 0$ and $\sin(t/2) > 0$

B $\cos(t/2) < 0$ and $\sin(t/2) > 0$

C $\cos(t/2) < 0$ and $\sin(t/2) < 0$

D $\cos(t/2) > 0$ and $\sin(t/2) < 0$

E There is not enough information to determine the answer.

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The angle t lies in quadrant III, so we might have $\pi < t < 3\pi/2$ in which case $\pi/2 < t/2 < 3\pi/4$ or $t/2$ lies in quadrant I and A holds. However, we might also have $3\pi < t < 7\pi/2$ and then $3\pi/2 < t < 7\pi/4$. In this case $t/2$ lies in quadrant III and C holds.

Question 4.

(Review) Solve for x, $4^x = 9$.

A $x = \ln(9)/\ln(4)$

B $x = \log(9)/\log(4)$

C $x = 9/4$

D $x = \ln(9)/4$

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We can apply the logarithm to any base to the equation to obtain $\log_a(4^x) = \log_a(9)$. Using a property of the logarithms, we have $x \log_a(4) = \log_a(9)$. And solving gives that $x = \log_a(9)/\log_a(4)$. Answer A is this formula with the base $a = e$ and answer B is this formula with $a = 10$.