DAE-Eng Maths Level Test(Theory)
-answers theory bundle-

Full Name: **Date:**

Knowledge/10 Explain in your own illustrated words:

- (trigonometric) Pythagorean Identity,

- free vector versus location vector,

- diffuse versus specular light,

- transpose of a matrix,

- linear operator.

specimen

Proofs/10

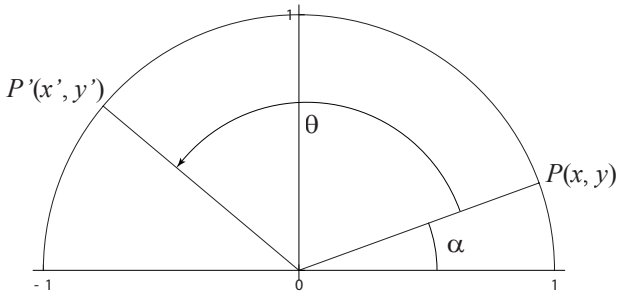
- Prove the Sum Identities $\cos(\alpha+\beta)$, $\sin(\alpha-\beta)$ and $\sin(\alpha+\beta)$ based upon $\cos(\alpha-\beta)$. Although $\cos(\alpha-\beta)$ itself remains without proof!

Specimen

- Prove the trigonometric foundation of the two-dimensional rotation operator $R_{O,\theta}$

  Rotating a point P on the unit circle, having P labeled as $(x, y) = (\cos\alpha, \sin\alpha)$, over a positive angle θ returns its image point P' labeled as

$$(x',\, y') = (\cos(\alpha + \theta),\, \sin(\alpha + \theta))\,.$$



  Start your reasoning from the Sum Identities for sine and cosine.

Specimen

Upon this DAE Maths Level Test (Theory)exam sample, do find two *exhaustive* target lists from which respectively its

knowledge-topics are recruited:

radian versus degree

similar versus congruent triangles

scalene triangle

hypotenuse

isosceles triangle

polygon

angle bisector

median (of a triangle)

altitude (of a triangle)

perpendicular bisector

(trigonometric) Pythagorean Identity

Law of Sines

Law of Cosines

sin versus arcsin

cos versus arccos

tan versus arctan

unit circle

oppositely signed angles

complementary angles

(trigonometric) Sum Identities

function domain versus function range

root with multiplicity

intersection point

tangent point

abs

intercept

slope

vertex of a parabola

(angular) frequency or pulsation

periodicity with a period

oscillation

amplitude

phase (horizontal shift)

scalar versus vector measure

uniform scaling

zero vector versus unit vector

free vector versus location vector

equal vectors

parallel vectors versus antiparallel vectors

base vectors

opposite vector

the dot product

square of a vector

commutative property

matrix versus determinant

the cross product

normal vector

anticommutative property

right-handed versus left-handed frame

normalized cross product

diffuse versus specular light

the half vector technique (in lighting)

overexposure (in lighting)

shininess (in lighting)

zero matrix versus identity matrix

square matrix

diagonal matrix

main diagonal versus anti diagonal (of a matrix)

determinant (of a matrix)

scalar multiplication (of a matrix)

opposite matrix

transpose of a matrix

symmetric matrix

matrix product

transpose of a matrix product

matrix power

inverse of a matrix

singular matrix versus invertible matrix

inverse of a matrix product

linear operator

translation operator

homogeneous coordinates

(standard) scaling operator

(standard) rotation operator

roll, pitch and yaw

(standard) reflection or mirroring operator

composite transformation operator

proof reproduction-questions are recruited:

Pythagorean theorem

Special angles (sin, cos, tan plus figure) of 30°, 45° and 60° purely via pen-and-paper

Sum Identities $\cos(\alpha + \beta)$, $\sin(\alpha - \beta)$ and $\sin(\alpha + \beta)$ based upon $\cos(\alpha - \beta)$. Although $\cos(\alpha - \beta)$ itself remains without proof!

Geometrical meaning of the dot product (subtended angle)

Criterion for orthogonality of vectors

Geometrical meaning of the cross product (subtended parallelogram)

Criterion for (anti)parallelism of vectors

Construct the specular lighting centered on the view vector $\vec{v}$

Construct the specular lighting by the halfvector $\vec{h}$ technique

Trigonometric foundation of the two-dimensional rotation operator $R_{O,\theta}$

IMPORTANT REMARK*: a proof is NOT an (illustrated) example of its targeted theorem or formula!*