GPN1-Q02

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Problem 1

Given two vectors $\vec{A} = 3\hat{i} - 2\hat{j}$ and $\vec{B} = -\hat{i} + 5\hat{j}$, find the vector $\vec{C}$ in the xy plane such that $|\vec{C}| = |\vec{A} + \vec{B}|$, but whose direction is perpendicular to $\vec{A} + \vec{B}$.
$\vec{C} = C_x\hat{i} + C_y\hat{j}$ $C_x > 0$ (02小題)

C_x=_____

01: **ANS:=3**

C_y=_____

02: **ANS:=-2**

Given two vectors, $\vec{A} = (2, 1, -1)$ and $\vec{B} = (-3, 2, 1)$, find the unit vector, $\hat{e}$ in the direction of $\vec{S} = 2\vec{B} - 3\vec{A}$. $\hat{e} = e_x\hat{i} + e_y\hat{j} + e_z\hat{k}$. (03小題)

e_x=_____

03: **ANS:=-0.92**

e_y=_____

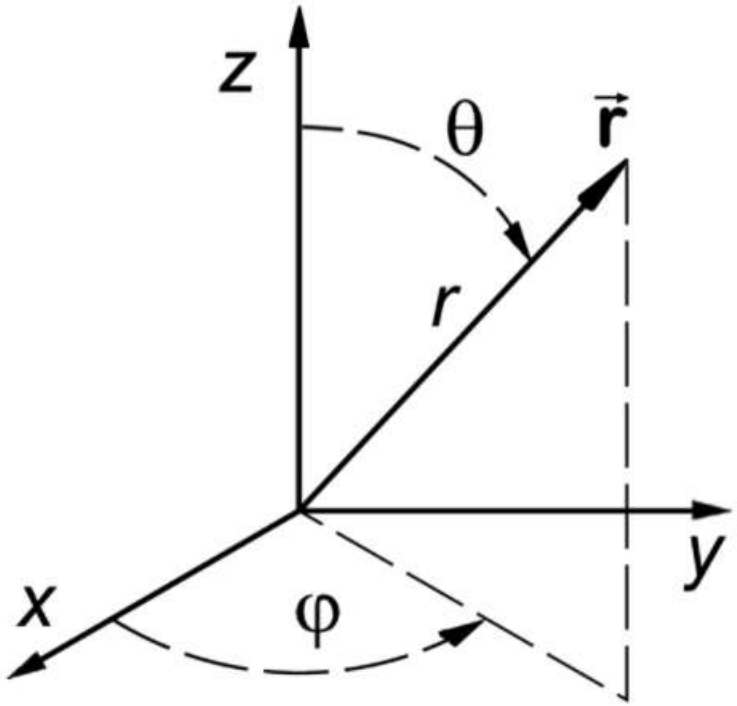
04: **ANS:=0.077**

e_z=_____

05: **ANS:=0.383**

Problem 2

The spherical coordinate is defined as in the figure. Given $r = 10, \theta = 40^\circ, \phi = 65^\circ$ find the components of $\vec{r}$ Cartisian coordinates. (03小題)



$\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$

(a)x=____

06: **ANS:=2.717**

(b)y=____

07: **ANS:=5.826**

(c)z=____

08: **ANS:=7.66**

What is the component of the vector $\vec{A} = \hat{i} - 2\hat{j} + \hat{k}$ in the direction of the vector $\vec{B} = -3\hat{i} + 4\hat{k}$? (02小題)

(a)the angle between 2 vectors (less than 90 degrees)=_____ degree

09: **ANS:=85.3**

(b)the component of $\vec{A}$ in the direction of $\vec{B}$=_____

10: **ANS:=0.2**

Problem 3

Vector Cross Product: PART.1 Find the vector product of $\vec{A} = 3\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{B} = \hat{i} + 4\hat{j} - 2\hat{k}$. (04小題)

$\vec{C} = \vec{A} \times \vec{B} = C_x\hat{i} + C_y\hat{j} + C_z\hat{k}$

C_x=____

11: **ANS:=0**

C_y=____

12: **ANS:=7**

C_z=____

13: **ANS:=14**

(d)A,B兩個向量所撐開來的平行四邊形面積=_____

14: **ANS:=15.65**

Problem 4

A projectile is fired with initial speed v_0 at angle θ above the horizontal from a point at the ground. Answer the following questions with variables : v_0=v0. θ=theta. (02小題)

(a)the time of flight from firing to hitting the ground=_____ [v_0, theta,g]

15: **ANS:=2*v_0*sin(theta)/g**

(b)the horizontal range=_____ [v_0,theta,g]

16: **ANS:=v_0**2*sin(2*theta)/g**

A ball moving in a circle of radius R with the period of T. Answer the following questions with R and T. (02小題)

(a)the speed of the ball v=_____ [R,T]

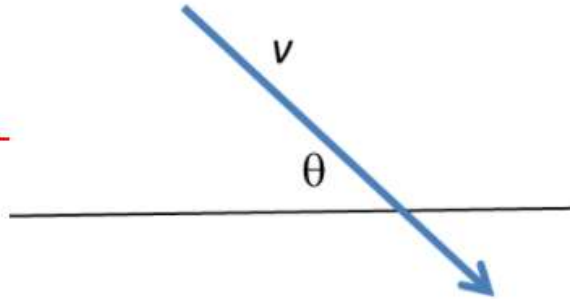
17: **ANS:=(2*pi*R)/T**

(b)the centripetal acceleration, a=_____ [R,T]

18: **ANS:=(4*pi**2*R)/(T**2)**

Problem 5

A projectile is hitting the ground in an angle θ and speed v as shown in the figure. Assume $v = 20$ m/s, $\theta = 55°$. Find the components of the velocity. (02小題)



$\vec{v} = v_x \hat{i} + v_y \hat{j}$

v_x=_____ m/s

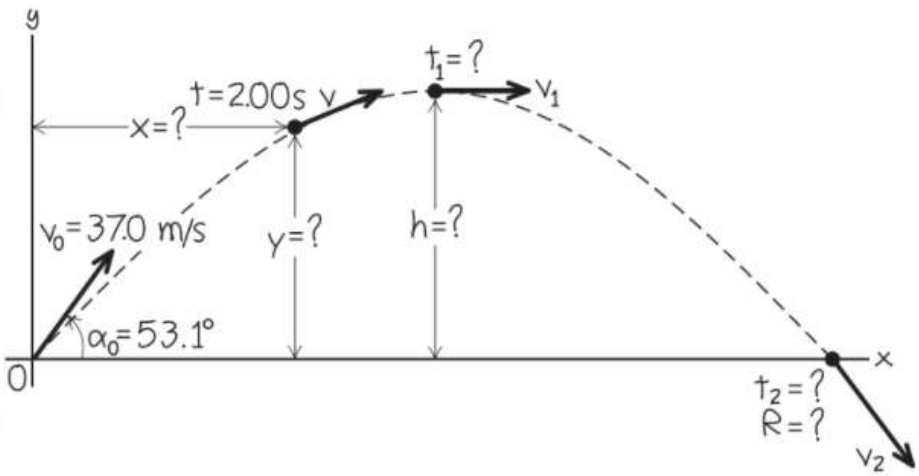
19: **ANS:=11.47**

v_y=_____ m/s

20: **ANS:=-16.38**

Problem 5

擊球手擊打棒球，使其以 $\theta = 53°$ 的速度 $v_0 = 37.0$ m/s 離開球棒。 以擊打地面的初始位置為原點。 在 t=2.0 s 處計算球的 (a) 位置及其 (b) 速度 (大小和方向) 。 求球到達飛行最高點的 (c) 時間，以及此時的 (d) 高度 h。 (e) 水平範圍 R。 (07小題)



(a)position at t=2 s:
x=_____ m

21: **ANS:=44.4**

y=_____ m

22: **ANS:=39.6**

(b)velocity at t=2 s, v_x=_____ m/s

23: **ANS:=22.2**

v_y=_____ m/s

24: **ANS:=10.0**

(c))time when the ball reaches the highest point, t_1=_____ s

25: **ANS:=3.02**

(d)the height h=_____ m

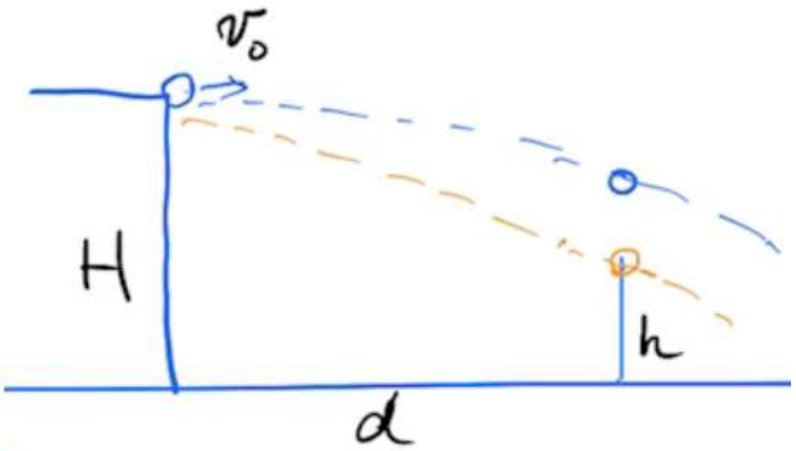
26: **ANS:=44.7**

(e)the horizontal range,R=_____ m

27: **ANS:=134**

Problem 6

A tennis ball is served at a height of $H = 2.4$ m at $v_0 = 30$ m/s in the horizontal direction. The net is $h = 0.9$ m high at a horizontal distance of $d = 12$ m. (a)Find the height of the tennis ball when it reaches the net. (b)If we decrease the initial speed of the tennis ball, the height of the ball passing the net will also decrease. (b)Find the minimal speed of the ball such that it will fly over the net. (02小題)



(a)the height of the ball=_____ m

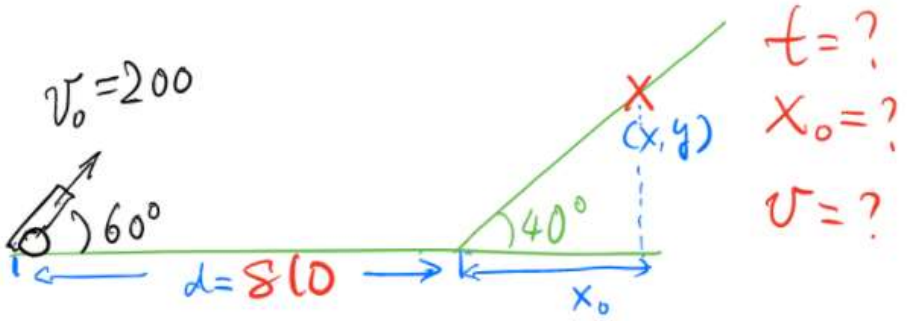
28: **ANS:=1.62**

(b)the minimal speed of the ball=_____ m/s

29: **ANS:=21.69**

Problem 7

如圖所示，一個砲彈正在向山上的目標射擊。 大砲距山底810 m。 初始速度為 200 m/s，方向與地平線成 60 度。 這座山可以近似為一個 40 度角的斜坡。 求 (a) 球擊中山的時間； (b) 擊球點距山腳的水平距離（見圖）； (c) 撞擊山體的速度大小。 (03小題)



(a)球擊中山的時間, t=_____ s

30: **ANS:=24**

(b)x_0=_____ m

31: **ANS:=1590**

(c)撞擊山體的速度大小,$|v|$=_____ m/s

32: **ANS:=117.7**

Problem 8

地球的半徑為 6380 公里，每 24 小時繞地軸自轉一圈。 (a) 物體在地球赤道的向心加速度是多少？ (b) 如果赤道的a_c 大於g，物體會飛離地球表面進入太空。 要發生這種情況，地球自轉的周期必須是多少？ (02小題)

(a)a_c=_____ m/s^2

33: **ANS:=0.034**

(b)T=_____ s

34: **ANS:=5070**