編號： 120

國立成功大學 104 學年度碩士班招生考試試題

系所組別：工程科學系丁、己組

考試科目：工程力學

考試日期：0212，節次：1

※ 考生請注意：本試題不可使用計算機。 請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

靜力學部分

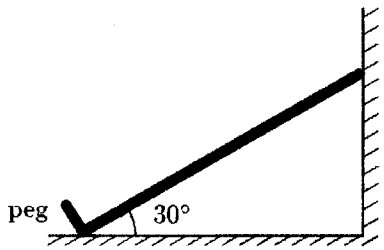
注意: 靜力學共有七題，第一到第五題，每題只有一個答案，第六、第七題爲計算題。批改人員將只核對每題的最後答案，計算或誘導過程不必列出。請考生將每題的答案 (若有單位請包含單位) 以方框標註出來，以利批改考卷。

1. (4%) If the x component of a vector $\vec{A}$, in the xy plane, is half as large as the magnitude of the vector, determine the tangent of the angle between the vector and the x axis.

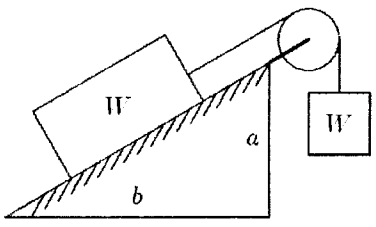
2. (4%) Let $\vec{S} = (1\text{m})\hat{i} + (2\text{m})\hat{j} + (2\text{m})\hat{k}$ and $\vec{T} = (3\text{m})\hat{i} + (4\text{m})\hat{k}$. Determine the angle between these two vectors.

3. (4%) A man wishes to pull a crate 15m across a rough floor by exerting a force of 100N. The coefficient of kinetic friction is 0.25. For the man to do the least work, determine the angle between the force and horizontal.

4. (4%) A uniform ladder is 10m long and weighs 400N. It rests with its upper end against a frictionless vertical wall. Its lower end rest on the ground and is prevented from slipping by a peg driven into the ground. The ladder makes a $30°$ angle with the horizontal. Determine the magnitude of the force exerted on the peg by the ladder.



5. (4%) The system shown remains at rest. Each block weights 20N. Determine the force of friction on the upper block.



$W = 20\,\text{N}$
$a = 3\,\text{m}$
$b = 4\,\text{m}$

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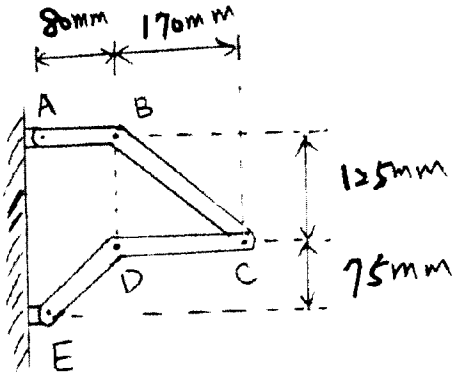
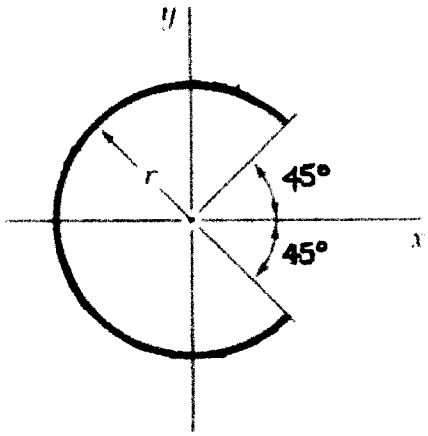
6. (16%) Determine components of reactions at A and E if a $36N \cdot m$ ↻ couple is applied (a) at B (b) at D.



7. (14%) A homogeneous wire is bent into the shape shown. Determine its centroid.



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注意： 第8至第14題為動力學部分，每題都是單選題，答錯不倒扣分數。批改人員只核對每題的答案（A-E）而不核對計算過程。請將每題的答案（A-E）寫在你的答案紙上並標註題號。若你只寫數值答案，則該題以零分計（譬如第8題若你的計算結果是 100 m，則應該寫A而非100 m）。

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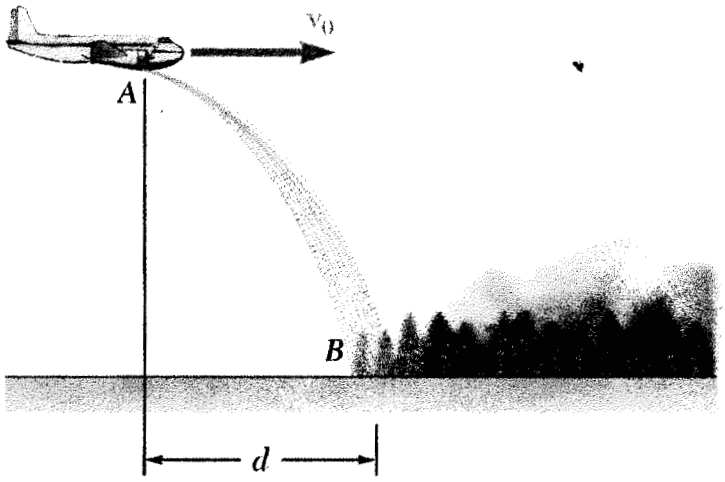
8. (5%) An airplane used to drop water on fires is flying horizontally in a straight line at 360 km/h at an altitude of 80 m. Which of the following is the estimated distance d at which the pilot should release the water so that it will hit the fire at B?

(A) 100 m
(B) 200 m
(C) 300 m
(D) 400 m
(E) 500 m



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9. (5%) A hockey player hits a puck so that it comes to rest in 9 seconds after sliding 27 m on the ice. Which of the following is the estimated coefficient of friction between the puck and the ice?
(A) 0.05 (B) 0.07 (C) 0.09 (D) 0.11 (E) 0.13

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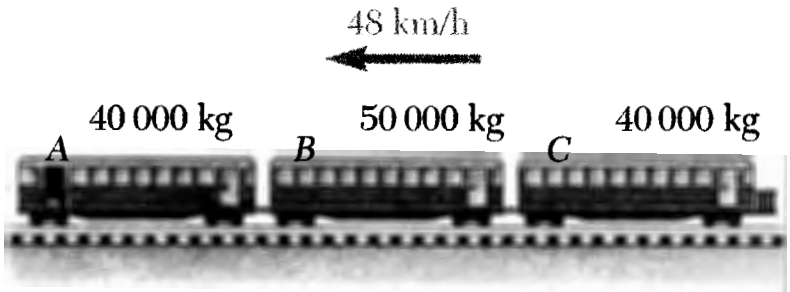
10. (5%) The train shown is traveling at a speed of 48 km/h when the brakes are fully applied on all the wheels of cars B and C, causing them to slide on the track, but are not applied on the wheels of car A. Knowing that the coefficient of kinetic friction is 0.4 between the wheels and the track. Which of the following is the estimated distance required to bring the train to a stop?

(A) 11 m
(B) 22 m
(C) 33 m
(D) 44 m
(E) 55 m



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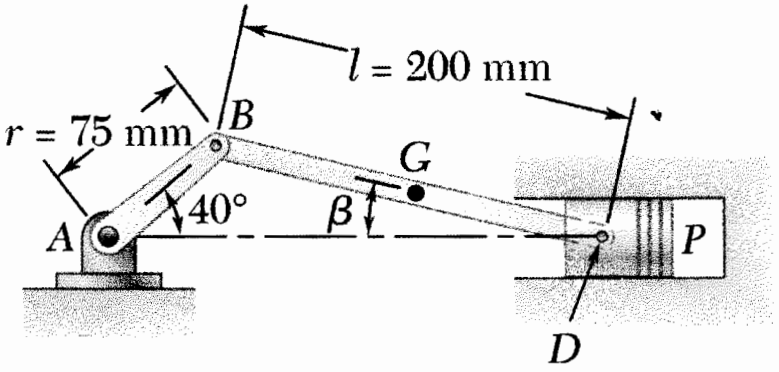
11. (5%) In the engine system shown, the crank *AB* has a constant angular speed of 3000 rpm. Which of the following is the estimated magnitude of the acceleration at point *B*?

(A) 4400 m/s^2
(B) 5400 m/s^2
(C) 6400 m/s^2
(D) 7400 m/s^2
(E) 8400 m/s^2



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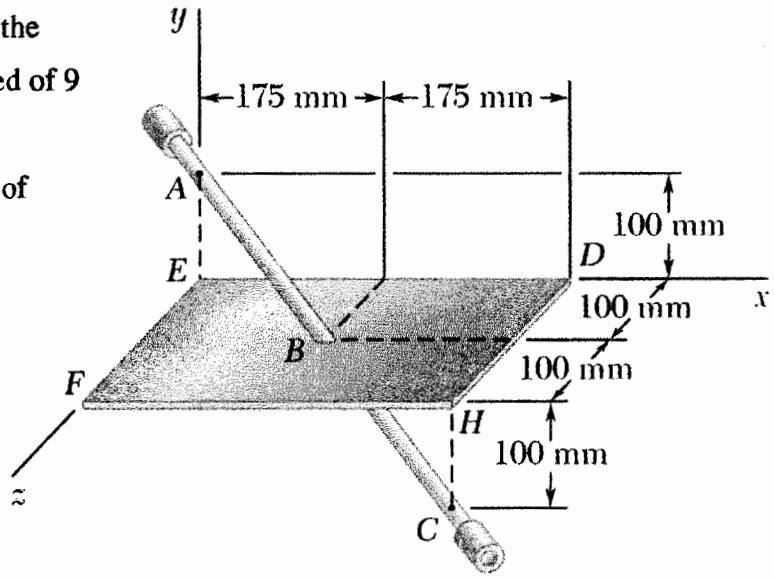
12. (10%) The assembly shown consists of the straight rod *ABC*, which passes through and is welded to the rectangular plate *DEFH*. The assembly rotates about the axis *AC* with a constant angular speed of 9 rad/s. Which of the following is the estimated magnitude of the velocity of corner *F*?

(A) 0.8 m/s
(B) 1.0 m/s
(C) 1.2 m/s
(D) 1.4 m/s
(E) 1.6 m/s



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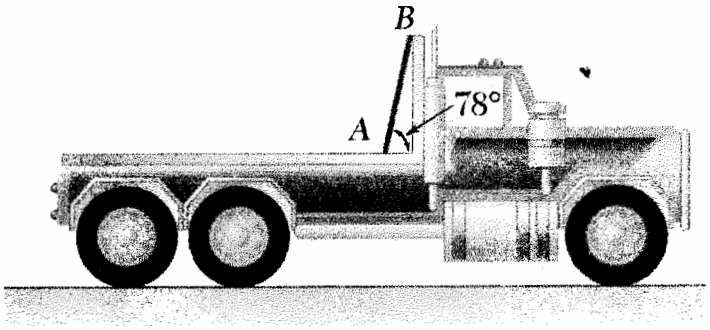
13. (10%) A 2-m board is placed in a truck with one end resting against a block secured to the floor and the other leaning against a vertical partition. Which of the following is the estimated maximum allowable acceleration of the truck if the board is to remain in the position shown? ($\cos 78^\circ \approx 0.208, \sin 78^\circ \approx 0.978, \tan 78^\circ \approx 4.705$)

(A) 2.1 m/s^2
(B) 2.3 m/s^2
(C) 2.5 m/s^2
(D) 2.7 m/s^2
(E) 2.9 m/s^2



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14. (10%) A slender rod of length l and weight W is pivoted at one end as shown. It is released from rest in a horizontal position and swings freely. What is the magnitude of the angular velocity of the rod as it passes through a vertical position?

(A) $\sqrt{\frac{g}{l}}$ (B) $\sqrt{\frac{3g}{l}}$ (C) $\sqrt{\frac{4g}{l}}$ (D) $\sqrt{\frac{6g}{l}}$ (E) $\sqrt{\frac{12g}{l}}$