

國立高雄大學 101 學年度轉學招生考試試題(轉二年級)

科目：微積分
考試時間：80 分鐘

系所：
電機工程學系(無組別)
本科原始成績：100 分

是否使用計算機：是

- 共十題，每題十分。
- 請依題號順序作答，否則酌予扣分。

1. Find dy/dx if y is defined as a function of x in each of the following:

(a) $y = 2^{3x}$

(b) $y = \log_{10}(3x^2 + 4)$

(c) $y = x^2 e^{-2x}$

(d) $y = (\ln x)/x$

(e) $y = \sqrt{1 + e^{2x}}$

2. Find d^2y/dx^2 if $x^4 + y^4 = 16$.

3. Evaluate $\int \frac{x^2 + 2x - 1}{2x^3 + 3x^2 - 2x} dx$.

4. Find the area enclosed by the line $y = x - 1$ and the parabola $y^2 = 2x + 6$.

5. Find the volume of the solid obtained by rotating the region bounded by

$y = x - x^2$ and $y = 0$ about the line $x = 2$.

6. Find the n th Taylor polynomial for $\frac{1}{x}$ about $x = 1$.

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7. (a) Find the area of the region in the first quadrant that is within the cardioid

$$r = 1 - \cos \theta .$$

(b) Find the entire area within the cardioid of (a).

8. Find the directional derivative of $f(x, y, z) = x^2y - yz^3 + z$ at the point $(1, -2, 0)$ in the direction of the vector $\vec{a} = 2\vec{i} + \vec{j} - 2\vec{k}$.

9. Find the volume of the solid within the cylinder $x^2 + y^2 = 9$ and between the planes $z = 1$ and $x + z = 5$.

10. Evaluate

$$\int_C 2xydx + (x^2 + y^2)dy$$

along the circular arc C given by $x = \cos t$, $y = \sin t$ ($0 \leq t \leq \pi/2$).

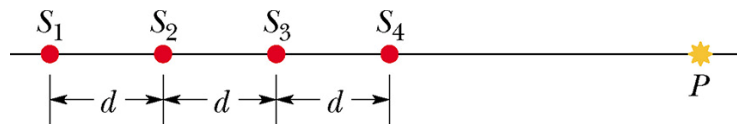
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科目：物理
 考試時間：80 分鐘

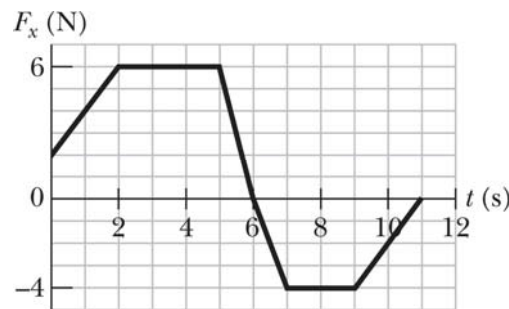
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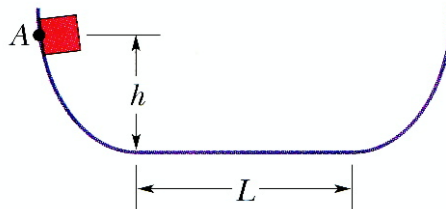
1. (15%) The figure shows four isotropic point sources of sound that are uniformly spaced on an x axis. The sources emit sound at the same wavelength λ and same amplitude s_m , and they emit in phase. A point P is shown on the x axis. Assume that as the sound waves travel to P , the decrease in their amplitude is negligible. What multiple of s_m is the amplitude of the net wave at P if distance d in the figure is (a) $\lambda/4$, (b) $\lambda/2$, and (c) λ ? Explain.



2. (15%) The figure gives, as a function of time t , the force component F_x that acts on a 3.00 kg ice block that can move only along the x axis. At $t = 0$, the block is moving in the positive direction of the axis, with a speed of 3.00 m/s. What are its (a) speed and (b) direction of travel at $t = 11.0$ s?



3. (10%) A particle can slide along a track with elevated ends and a flat central part as shown. The flat part has length $L = 40$ cm. The curved portions of the track are frictionless, but for the flat part the coefficient of kinetic friction is $\mu_k = 0.20$. The particle is released from rest at point A , which is at height $h = L/2$. How far from the left edge of the flat part does the particle finally stop?



4. (15%) A long solenoid with 10.0 turns/cm and a radius of 7.00 cm carries a current of 20.0 mA. A current of 6.00 A exists in a straight conductor located along the central axis of the solenoid. (a) At what radial distance from the axis will the direction of the resulting magnetic field be at 45.0° to the axial direction? (b) What is the magnitude of the magnetic field there?

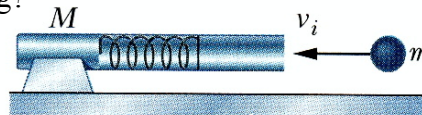
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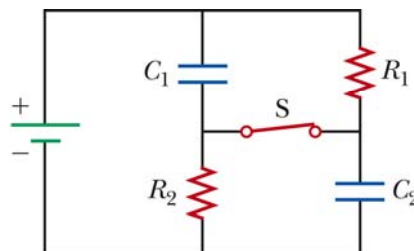
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5. (15%) A ball of mass $m = 60.0 \text{ g}$ is shot with speed $v_i = 22.0 \text{ m/s}$ into the barrel of a spring gun of mass $M = 240 \text{ g}$ initially at rest on a frictionless surface as shown. The ball sticks in the barrel at the point of maximum compression of the spring. Assume that the increase in thermal energy due to friction between the ball and the barrel is negligible. (a) What is the speed of the spring gun after the ball stops in the barrel? (b) What fraction of the initial kinetic energy of the ball is stored in the spring?



6. (15%) A switch S as shown has been closed for a very long time, and the electric circuit carries a constant current. Take $C_1 = 2.00 \mu\text{F}$, $C_2 = 5.00 \mu\text{F}$, $R_1 = 3.00 \text{ k}\Omega$, and $R_2 = 7.00 \text{ k}\Omega$. The power delivered to R_2 is 2.50 W . (a) Find the charge on C_1 . (b) Now the switch is opened. After many milliseconds, by how much has the charge on C_2 changed?



7. (15%) Two waves of light in air, of wavelength $\lambda = 600 \text{ nm}$, are initially in phase. They then travel through plastic layers as shown, with $L_1 = 4.00 \mu\text{m}$, $L_2 = 3.50 \mu\text{m}$, $n_1 = 1.40$, and $n_2 = 1.60$. (a) What multiple of λ gives their phase difference after they both have emerged from the layers? (b) If the waves later arrive at some common point with the same amplitude, is their interference fully constructive, fully destructive, intermediate but closer to fully constructive, or intermediate but closer to fully destructive?

