PHYS 101: General Physics 1 **KOÇ UNIVERSITY** **Fall Semester 2012**

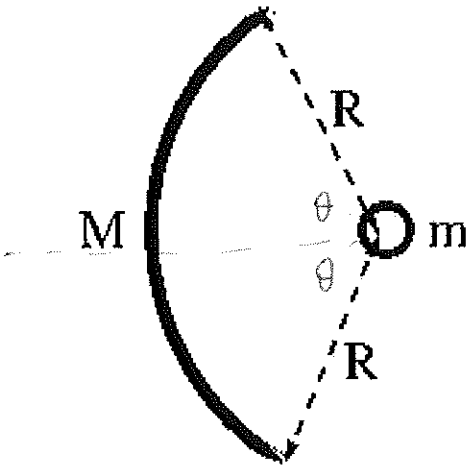
College of Sciences

Section 1 **Quiz 9** **29 November 2012**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 15 minutes

Name: **Student ID:** **Signature:**

Consider the isolated system of an arc of a circular wire and a point object that is shown in the figure. The radius and mass of the arc are R and M, respectively. You may assume the arc is one dimensional, that is you may ignore its thickness. Find the escape speed of the point mass m from the gravitational potential of the arc.



$$dU = -\frac{G m dM}{R}$$

$$dM = \frac{M}{2\theta R} R d\theta'$$

$$\int dU = \int_{-\theta}^{\theta} -\frac{G m M}{R 2\theta} d\theta'$$

$$U = -\frac{G m M}{R}$$

$$v_{escape} = \sqrt{\frac{2GM}{R}}$$

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Section 2 **Quiz 9** **29 November 2012**

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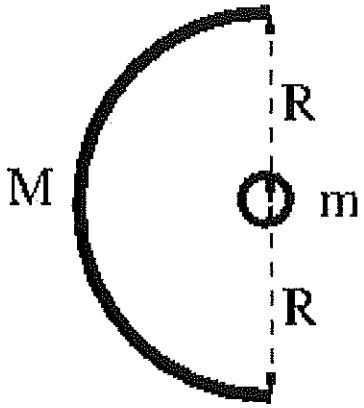
Quiz duration: 15 minutes

Name: **Student ID:** **Signature:**

Consider the isolated system of a semi-circular wire and a point object that is shown in the figure. The radius and mass of the semi-circular wire are R and M, respectively. You may assume the wire is one dimensional, that is you may ignore its thickness. Find the escape speed of the point mass m from the gravitational potential of the semi-circular wire.



$$dU = -\frac{GmdM}{R} \qquad dM = \frac{M}{\pi R} R d\vartheta$$

$$U = \int_{-\pi/2}^{\pi/2} -\frac{GmM}{\pi R} d\vartheta = -\frac{GmM}{R}$$

$$v_{escape} = \sqrt{\frac{2GM}{R}}$$

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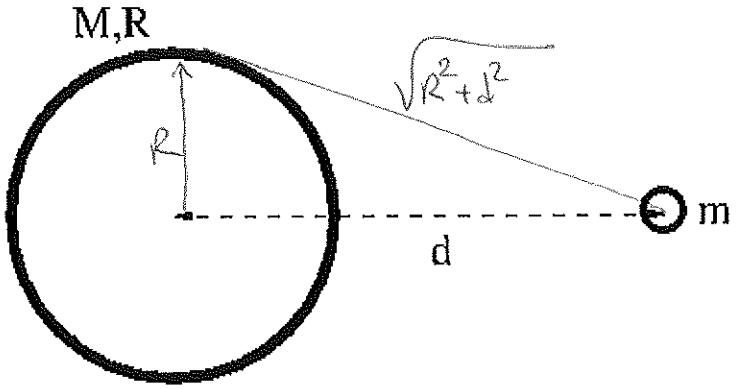
Section 3 **Quiz 9** **29 November 2012**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 15 minutes

Name: **Student ID:** **Signature:**

Consider the isolated system of a circular wire and a point object that is shown in the figure. The radius and mass of the circular wire are R and M, respectively. You may assume the wire is one dimensional, that is you may ignore its thickness. Find the escape speed of the point mass m from the gravitational potential of the circular wire.



$$dU = \frac{-G m dM}{\sqrt{R^2+d^2}}$$

$$U = -\int \frac{G m dM}{\sqrt{R^2+d^2}} = -\frac{G m M}{\sqrt{R^2+d^2}}$$

$$K_1 + U_1 = K_2 + U_2$$

$$\frac{1}{2} m v_{esc}^2 + U = 0$$

$$\frac{1}{2} m v_{esc}^2 = \frac{G m M}{\sqrt{R^2+d^2}} \Rightarrow v_{esc} = \sqrt{\frac{2GM}{\sqrt{R^2+d^2}}}$$

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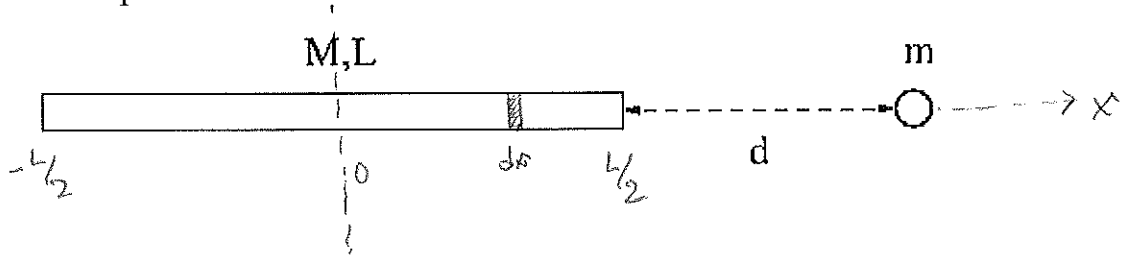
Section 4 **Quiz 9** **29 November 2012**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 15 minutes

Name: **Student ID:** **Signature:**

Consider the isolated system of a straight wire and a point object that is shown in the figure. The length and mass of the wire are L and M, respectively. You may assume the wire is one dimensional, that is you may ignore its thickness. Find the escape speed of the point mass m from the gravitational potential of the wire.



$$U = -\int \frac{G m\, dM}{r} \qquad dM = \frac{M}{L}\, dx$$

$$r = d + \frac{L}{2} - x$$

$$U = -\frac{GmM}{L} \int_{-\frac{L}{2}}^{L/2} \frac{dx}{d+\frac{L}{2}-x} = -\frac{GmM}{L} \ln\left(\frac{d+L}{d}\right)$$

$$v_{escape} = \sqrt{\frac{GM}{L} \ln\left(\frac{d+L}{d}\right)}$$

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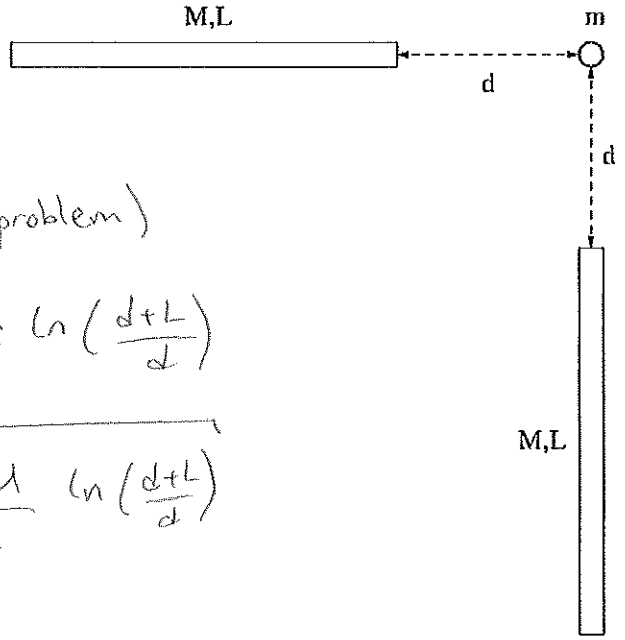
Section 5 **Quiz 9** **29 November 2012**

Closed book. No calculators are to be used for this quiz.
Quiz duration: 15 minutes

Name: **Student ID:** **Signature:**

Consider the isolated system of two straight wires and a point object that is shown in the figure. The length and mass of the wires are L and M, respectively. You may assume the wires are one dimensional, that is you may ignore their thickness. Find the escape speed of the point mass m from the gravitational potential of the wires.



(From section 4 problem)

$$U_a = U_b = -\frac{GmM}{L}\ln\left(\frac{d+L}{d}\right)$$

$$v_{escape} = \sqrt{\frac{2GM}{L}\ln\left(\frac{d+L}{d}\right)}$$