

Due date: \_\_\_\_\_

Name: \_\_\_\_\_

1. The position of a particle is given by the equation  $s(t) = t^3 - 9t^2 + 24t + 1$  (where  $t \geq 0$  is measured in seconds and  $s$  is measured in meters).
- What is the velocity after 1 second?
  - When is the particle at rest?
  - When is the particle moving in the positive direction?
  - Find the total distance traveled during the first 6 seconds. Be sure to include units for your answer.
  - When is the particle speeding up? When is it slowing down?

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2. The position of a particle is given by the equation  $s(t) = t^3 - 3t + 5$  (where  $t \geq 0$  is measured in seconds and  $s$  is measured in meters).
- When is the particle at rest?
  - When is the particle moving in the positive direction?
  - Find the total distance traveled during the first 3 seconds. Be sure to include units for your answer.
  - Find the acceleration at time  $t$  and after 5 seconds. Be sure to include units for your answer.
  - When is the particle speeding up? When is it slowing down?

3. The position of a particle is given by the equation  $s(t) = t^3 - \frac{9}{2}t^2 + 6t + \frac{1}{2}$  (where  $t \geq 0$  is measured in seconds and  $s$  is measured in meters).
- When is the particle at rest?
  - Find the total distance traveled during the first 3 seconds. Be sure to include units for your answer.
  - Find the acceleration after 1 second. Be sure to include units for your answer.
  - When is the particle speeding up? When is it slowing down?

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4. A spherical ball is being inflated. Find the rate of increase of the surface area with respect to the radius  $r$  when  $r$  is 2 inches. What about 3 inches? 4 inches? Explain what is happening to the rate of increase of the surface area as the ball is being inflated. Be sure to write units for your answer.
5. How fast is the area of a circle changing with respect to the radius when the radius is 3 cm? 4 cm? 5 cm? Explain what is happening to the rate of increase of the area as the radius of the circle is increasing. Be sure to write units for your answer.
6. How fast is the volume of a sphere changing with respect to the radius when the diameter is 6 cm? Be sure to write units for your answer.
7. How fast is the circumference of a circle changing with respect to the radius when the area is  $4 \text{ ft}^2$ ? Be sure to write units for your answer.

8. The mass of a thin rod from the left end to a point  $x$  mm to the right is  $\sqrt{x + 2}$  grams. Find the linear density when  $x$  is 7 mm. Be sure to write units for your answer.

9. The mass of a thin rod from the left end to a point  $x$  inches to the right is  $\sqrt[3]{2x + 1}$  ounces. Find the linear density when  $x$  is 13 inches. Be sure to write units for your answer.

**Review**

10. Differentiate the following functions.

a)  $f(x) = 3^{\sin 2x}$

b)  $y = \frac{2}{x} + x^2 e^{-x} - \csc(e^x)$

c)  $f(t) = \frac{1}{\ln t} + \tanh(t^2)$

Q: Forward I am heavy, but backward I am not. What am I?

Optional exercises from the Stewart textbook if you'd like more practice:  
3.7 (p.233) #1abcdefgi, 3abcdefgi, 5-9 odd, 15, 17