Do Now

$$g(x) = \ln\left(\frac{x}{2x+1}\right)$$

$$g'(x) = \left(\frac{1}{\frac{x}{2x+1}}\right) \cdot \left(\frac{(2x+1)(1) - (x)(2)}{(2x+1)^2}\right)$$

$$g'(x) = \frac{\cancel{2x+1}}{x} \cdot \frac{\cancel{2x}+1 - \cancel{2x}}{(2x+1)^{\cancel{2}}}$$

$$g'(x) = \frac{1}{x} \cdot \frac{1}{2x+1}$$

$$g'(x) = \frac{1}{x(2x+1)}$$

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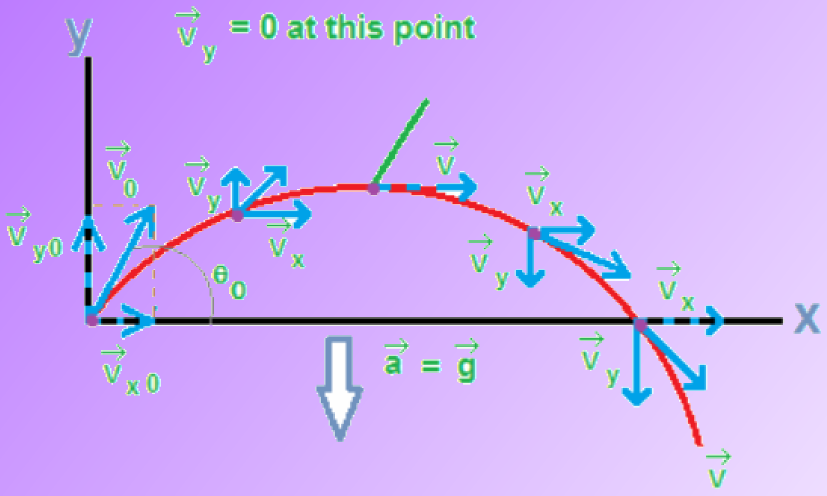
KINEMATICS



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KINEMATICS

Let $s(t)$ = the position at time t

Let $v(t)$ = the velocity at time t

Velocity = change in position in a given time period

$$= \frac{s(b)-s(a)}{b-a}$$

= slope of the $s(t)$ function

$$= s'(t)$$

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KINEMATICS

So we have $s(t)$ = the position at time t

and $v(t)$ = the velocity at time t

$$= s'(t)$$

Acceleration = change in velocity over time

$$a(t) = \frac{v(b)-v(a)}{b-a}$$

= slope of the $v(t)$ function

$$= v'(t)$$

$$= s''(t)$$

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KINEMATICS

1st derivative

2nd derivative

S(t) position

V(t) velocity

A(t) acceleration

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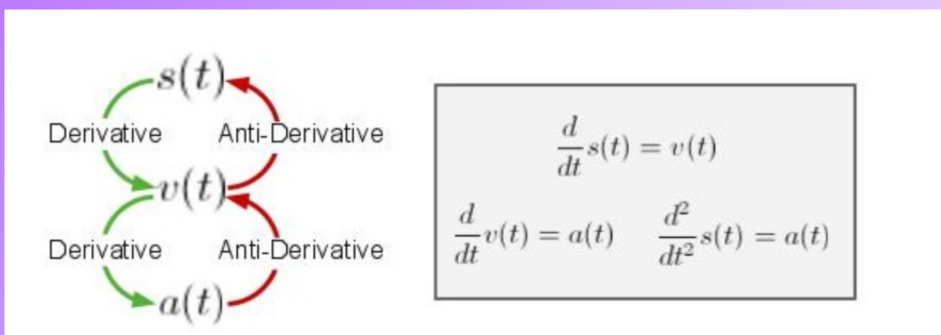
KINEMATICS



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KINEMATICS

Exercise 7N

Use a GDC to help evaluate function values.

EXAM-STYLE QUESTION

1 A ball is thrown vertically upwards. Its height in metres above the ground t seconds after it is thrown is modeled by the function $h(t) = -4.9t^2 + 19.6t + 1.4$

a Find the height of the ball when $t = 0$ seconds and when $t = 2$ seconds.

b Find the average rate of change of the height of the ball from $t = 0$ seconds to $t = 2$ seconds.

c Find the instantaneous rate of change of the height of the ball when $t = 1$ second, $t = 2$ seconds and $t = 3$ seconds. Explain what these values tell you about the motion of the ball.

a) $h(0) = 1.4$
$h(2) = 21$

b) avg rate of change $= \dfrac{21 - 1.4}{2 - 0} = 9.8$

c) $h'(t) = -9.8t + 19.6$
$h'(1) = 9.8$
$h'(2) = 0$
$h'(3) = -9.8$

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KINEMATICS

P. 223 #2

2 The amount of water in a tank after t minutes is modeled by the function $V(t) = 4000\left(1 - \dfrac{t}{60}\right)^2$, where V is measured in litres.

Answer the following to the nearest whole number.

a Find the amount of water in the tank when $t = 0$ minutes and when $t = 20$ minutes.

b Find the average rate of change of the amount of water in the tank from when $t = 0$ minutes to $t = 20$ minutes. Explain the meaning of your answer.

c Find the instantaneous rate of change of the amount of water in the tank when $t = 20$ minutes. Explain the meaning of your answer.

d Show that the amount of water in the tank is never increasing from $t = 0$ minutes to $t = 40$ minutes.

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