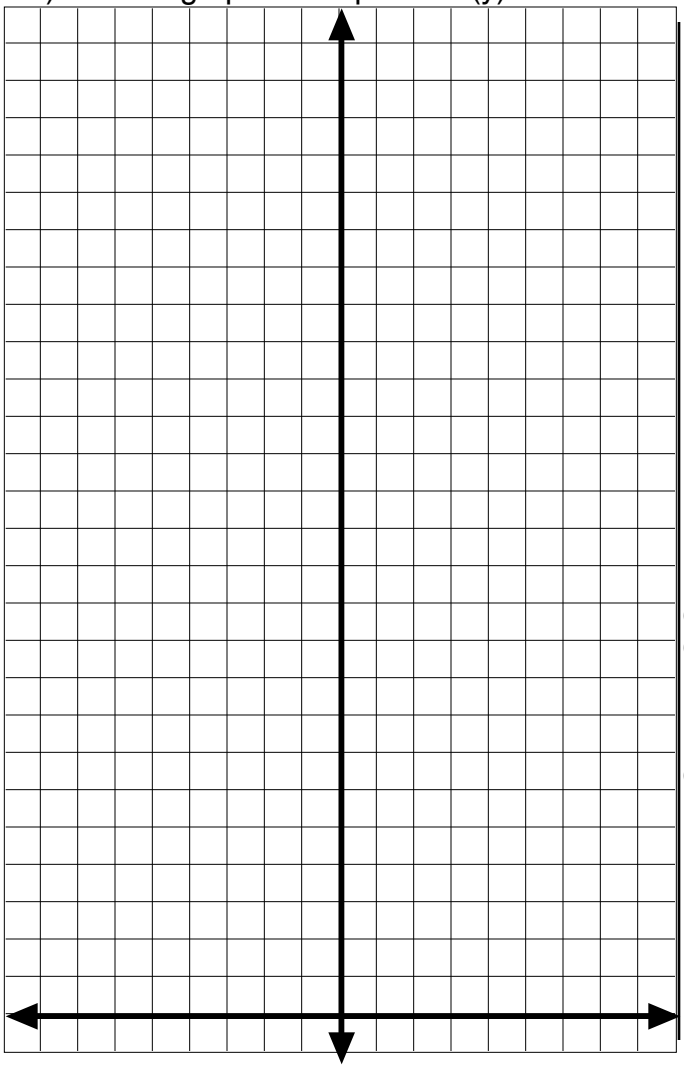
Name: _____ **TC**

Classwork 29

1. A bird is accelerating upwards. The displacement of the bird over time is described by $y = x^2$.
   a) Draw a graph of the position (y) of the bird over time (x) in seconds.



b) Find the average speed (slope) over each interval.

i. 0 s to 2 s

ii. 2 s to 4 s

iii. 4 s to 6 s

iv. 6 s to 8 s

v. 8 s to 10 s

vi. 10 s to 12 s

c) Write the physics equation for displacement under constant acceleration.

Prove that the **average velocity** over an interval occurs at the **midpoint** of the time interval.

d) Given that the average speed occurs at the midpoint of the time interval, fill out this chart with the interval, the average speed, and the time at which it occurs.

interval	average speed	time at which it occurs	
0 - 2 s			
2 - 4 s			
4 - 6 s			
6 - 8 s			
8 - 10 s			
10 -12 s			

e) Write a general rule for the relationship between the instantaneous speed and the time at which it occurs.

f) How could we write a **limit expression** for the instantaneous speed (slope at the point) for any value x? Remember, we want the change in x to approach zero....

g) Use this expression to find the slope at $x = 10$ and $x = -10$.

h) This limit is called the **derivative.** Find the derivative for $y = x^3$

i) Use this expression to find out when the slope of the curve equals 1.

j) Find the derivative for $y = x^4$.

Practice Problems

1. Find the derivative of $y = 2x$. (Why do you know this answer already?)

2. Find the derivative of $y = 4x^2$.

3. Find the derivative of $y = x^5$.