

MATH 1a
Problem Sheet A: 1-5

- (1)
- (a) Functions that are positive, increasing, and concave up on the entire domain should be above the x-axis, $f(x)$ should be greater as x increases, and the rate of change from $f(x)$ to $f(x+h)$ should be increasing as x increases.
 - (b) Functions that are positive, decreasing, and concave down cannot exist on the entire domain, but can be drawn from $[-1, 1]$.
 - (c) This function can be drawn on the entire domain, should be getting closer to 0 as x increases.
 - (d) Functions that are negative, decreasing, and concave up cannot exist on the entire domain, as they must turn the corner and start to increase if they are concave up at some point. They can, however, be drawn on $[-1, 1]$.
- (2)
- (a) The functions will vary, but something like $1/x + 1$ will do.
 - (b) Any cyclical function like $\sin(x)$ would work for this part.
- (3)
- (a)
 - (i) Runner A starts out the fastest, followed by runner B and C as the slowest. During the course of the race, A slows, B stays constant, and C accelerates so that they all reach the end point in the same amount of time.
 - (ii) They all travel the same distance in the same time, so the averages are equal.
 - (iii) They are all even.
 - (b)
 - (i) A accelerates quickly, followed by B and C. The velocity of A is higher than either B or C for the entire race until the final second, then they are all running at the same pace
 - (ii) The average velocity of A is greater than B is greater than C.
 - (iii) For the reasons above, all of their average velocities are identical.
- (4)
- (I)
 - (a) $t > 0$, positive velocity
 - (b) $t < 0$, negative velocity
 - (c) D
 - (II)
 - (a) always positive
 - (b) never negative
 - (c) C
 - (III)

- (a) positive velocity from $(-2, 0)$ and $t > 2$
- (b) negative velocity from $t < -2$, and $(0, 2)$
- (c) A

(IV)

- (a) positive from $(-1, 0)$, $t > 1$
- (b) negative from $t < -1$, $(0, 1)$
- (c) B

- (5) When the position versus time graph is sloped downward, velocity is negative.
When it is flat, velocity is 0, and when it is upward sloping, velocity is positive.