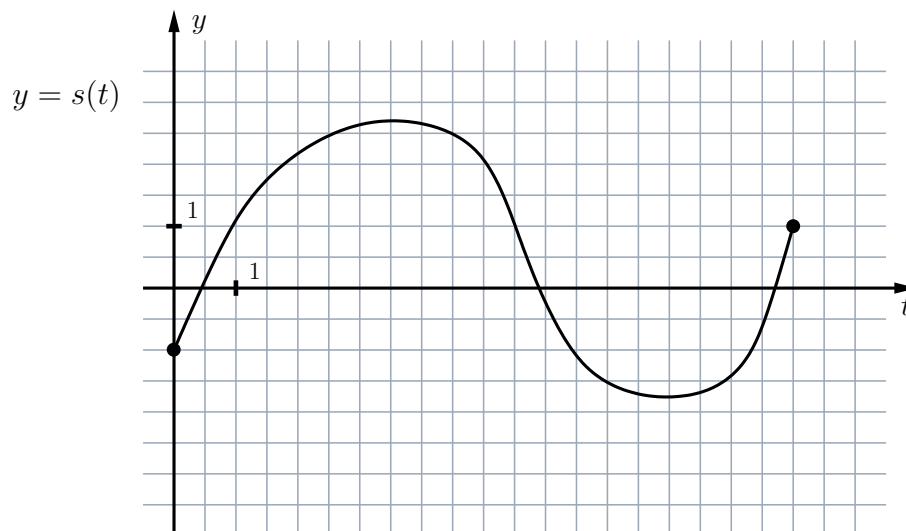


## Question 1:

- (a) The following is the graph of  $y = s(t)$ , the displacement of a particle in metres at time  $t$  seconds.



- (i)[2 points] Estimate the velocity at  $t = 2$  seconds. State units.
- (ii)[2 points] When is the particle at rest?
- (iii)[2 points] At what time did the velocity change from decreasing to increasing?
- (b)[4 points] The equation of motion of a particle is  $s(t) = 2t^3 - 3t^2 + 7$  where  $s$  is in metres and  $t$  in seconds. Determine the time at which acceleration is zero.

**Question 2:**

(a)[3 points] Differentiate:  $y = \frac{\cos(x)}{1+x^2}$

(b)[3 points] Differentiate:  $f(t) = 2\sqrt{t}\sec(t)$

(c)[4 points] Find  $\frac{dy}{dx}$ :  $y = \frac{4x^2e^x}{x^2 + \pi^2}$

**Question 3:**

(a)[3 points] Compute  $g'(1)$ :  $g(r) = 3e^r \sqrt[3]{8r}$

(b)[3 points] Differentiate:  $y = \left(x + \frac{1}{x^2}\right)^{-5}$

(c)[4 points] Differentiate:  $q(t) = \sin(t \csc(t))$

**Question 4:**

(a)[3 points] Find  $\frac{dy}{dz}$ :  $y = \sqrt{\tan(\sqrt{z})}$

(b)[3 points] Find  $y'$ :  $y = e^{x^7 \cos x}$

(b)[4 points] Compute  $f''(0)$ :  $f(x) = x^2 e^{x^3}$

**Question 5:**

(a)[5 points] Evaluate the limit  $\lim_{x \rightarrow \infty} \frac{2e^{5x} - e^x - 1}{3e^{5x} + 5e^{3x}}$

(b)[5 points] Find the equation of the tangent line to the curve  $x^3 + y^3 = 4xy + 1$  at the point  $(2, 1)$ .