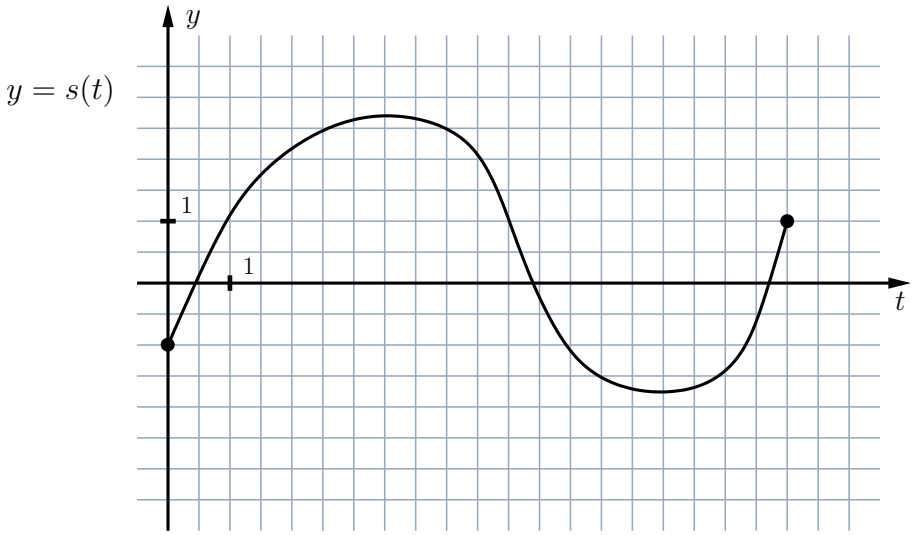
Question 1:

(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: $y = \dfrac{\cos(x)}{1+x^2}$

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

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

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: $q(t) = \sin\left(t \csc\left(t\right)\right)$

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 $\lim_{x\to\infty} \dfrac{2e^{5x} - e^x - 1}{3e^{5x} + 5e^{3x}}$

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