Question 1

7.   **(a)**   Differentiate $x^3 - 7x^2 + 6x$ with respect to x.

     (b)   **(i)**   Differentiate $\dfrac{3x+1}{x-2}$ with respect to x.

                 Write your answer in the form $\dfrac{k}{(x-2)^n}$, where $k, n \in \mathbb{Z}$.

          (ii)   Given that $y = (x^2 - 2x - 9)^4$, find the value of $\dfrac{dy}{dx}$ when $x = -2$.

     (c)   A ball is rolled in a straight line along a surface.
The distance, s metres, the ball travels is given by

$$s = 18t - 2t^2$$

where t is the time in seconds from the instant the ball begins to move.

          (i)   Find the speed of the ball after 3 seconds.

          (ii)   How far is the ball from the starting point when it stops moving?

          (iii)   Show that the speed of the ball decreases at a constant rate while it is moving.

7. **(a)** Differentiate with respect to x

(i) x^7

(ii) $5x - 3x^4$.

(b) **(i)** Differentiate $(1 + 3x)(4 - x^2)$ with respect to x.

(ii) Given that $y = (3x^2 - 4x)^3$, find $\dfrac{dy}{dx}$ when $x = 1$.

(c) A distress flare is tested by firing it vertically upwards from the top of a tower. The height, h metres, of the flare above the ground is given by

$$h = 20 + 90t - 5t^2$$

where t is the time in seconds from the instant the flare is fired.
The flare is designed to explode 7 seconds after firing.

(i) Find the height above the ground at which the flare explodes.

(ii) Find the speed of the flare at the instant it explodes.

(iii) If the flare failed to explode, find the greatest height above the ground it would reach before falling back down.