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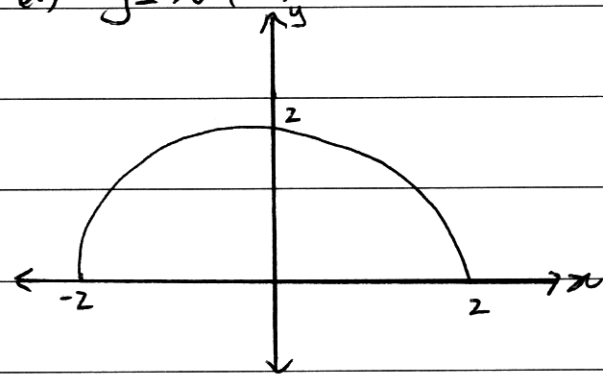
NEW SOUTH WALES

Question 6

(6) (a) $y = \sqrt{4 - x^2}$



Range: $0 \leq y \leq 2$

(b) $f'(x) = 3(x+1)(x-3)$

(i) Integrating $f'(x) = 3x^2 - 6x - 9$

$f(x) = x^3 - 3x^2 - 9x + C$

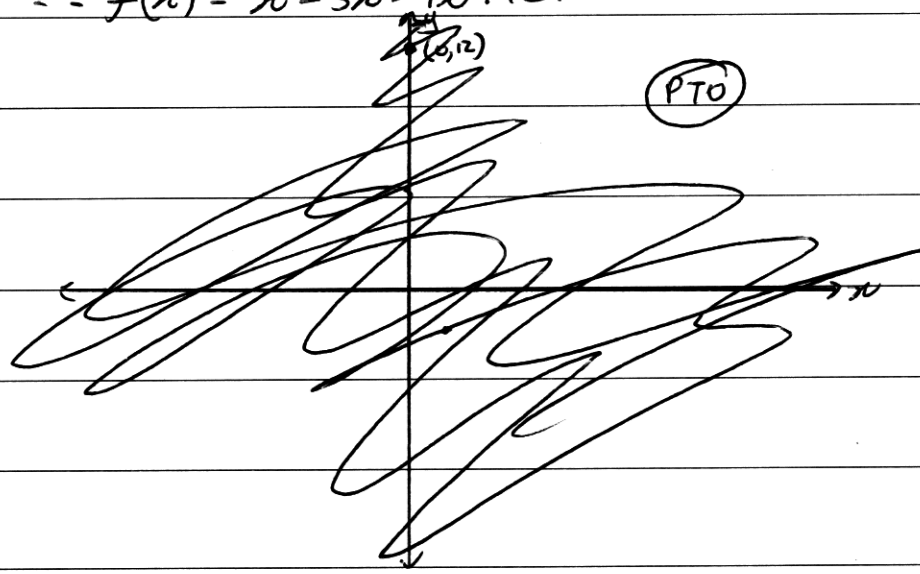
when $x = 0$, $f(x) = 12$

$12 = 0 - 0 - 0 + C$

$\therefore C = 12$

$\therefore f(x) = x^3 - 3x^2 - 9x + 12.$

(ii)



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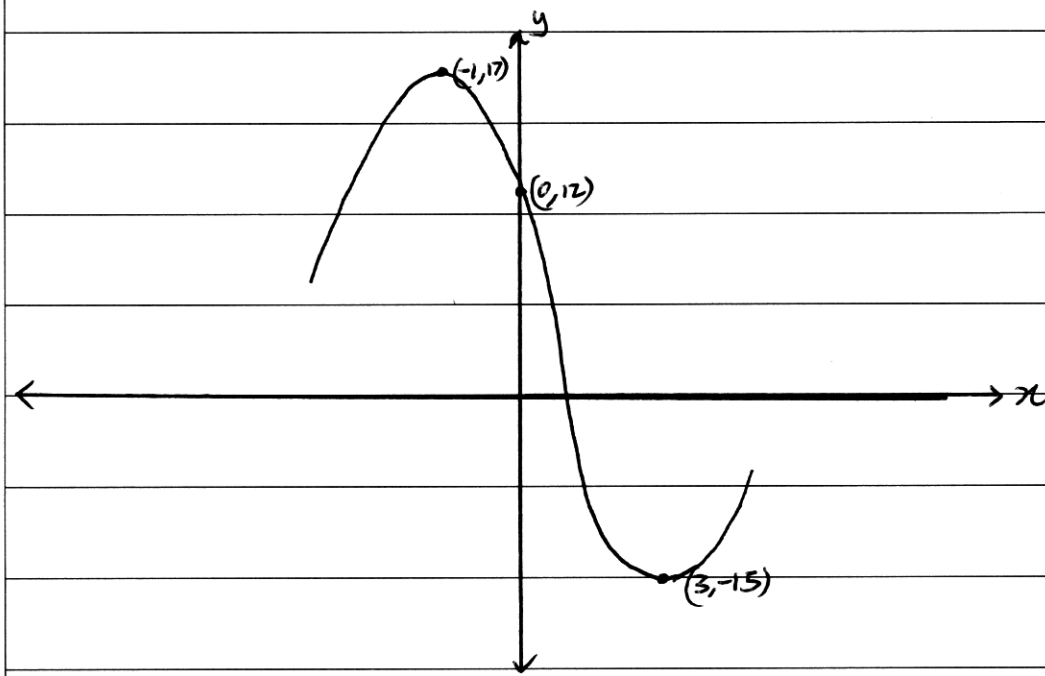
(ii) T.P. at $x=-1, y=17$ y-intercept $= (0,12)$

$x=3, y=-15$



$f''(x) = 6x-6$

$x=-1, f''(x) < 0 \therefore$ max

$x=3, f''(x) > 0 \therefore$ min

(iii) For x-values concave up: $x > 1$

(c) $V = \pi\int_0^2 \left(\frac{x^4}{4}\right)^2 dx = \pi\int_0^2 \left(\frac{x^8}{16}\right) dx =$

$= \pi\left[\frac{1}{144}x^9\right]_0^2$

$= \pi\left[\left(\frac{2^9}{144}\right) - (0)\right]$

$= \pi\left(3\frac{5}{9}\right)$

$= 3\frac{5}{9}\pi \text{ u}^3$