Additional Mathematics Exercise 15 Answers

(*Applications of Differentiation in Coordinate Geometry*)

1. tangent: $x-2y+1=0$, normal: $2x+y-3=0$
2. tangent: $x-6y+17=0$, normal: $6x+y-46=0$
3. tangent: $27x-6\sqrt{3}y+54+\sqrt{3}\pi=0$, normal: $4\sqrt{3}x+18y+8\sqrt{3}-3\pi=0$
4. tangent: $2x+4y-5=0$, normal: $4x-2y-5=0$
5. (1, –1), tangent at (1, –1): $3x-y-4=0$; (–1, –3), tangent at (–1, –3): $3x-y=0$
6. (a) (1, –6), (5, 18)
   (b) tangent at (1, –6): $2x-y-8=0$, tangent at (5, 18): $10x-y-32=0$
7. (a) $-\dfrac{2x+ay}{ax+2by}$ (b) $a=\dfrac{10}{3}$, $b=\dfrac{13}{3}$
8. (a) $3x-y+1=0$ (b) (–2, –5)
9. maximum $=\dfrac{76}{27}$, minimum $=-48$
10. maximum $=3$, minimum $\dfrac{5}{3}$
11. maximum $\dfrac{\sqrt{3}}{2}$, minimum $=-\dfrac{\sqrt{3}}{2}$
12. $\dfrac{1}{4}$, 1
13. (a) 1 (b) –
14. (a) $\dfrac{dy}{dx}=4x^3-4x$, $\dfrac{d^2y}{dx^2}=12x^2-4$
    (b) maximum = 0, minimum = –1
15. maximum $=\dfrac{3\sqrt{3}}{4}$, minimum $=-\dfrac{3\sqrt{3}}{4}$
16. (a) (–2, –3) (b) –3
17. (a) $\dfrac{dy}{dx}=\cos x-\sin x$, $\dfrac{d^2y}{dx^2}=-\sin x-\cos x$
    (b) greatest: $\sqrt{2}$, least: $-\sqrt{2}$
18. (a) no x-intercept and y-intercept
    (b) $\dfrac{dy}{dx}=2x-\dfrac{2}{x^3}$, $\dfrac{d^2y}{dx^2}=2+\dfrac{6}{x^4}$
    (c) no maximum point, minimum points = (1, 2), (–1, 2)
    (d) –
19. (a) x-intercepts: $\dfrac{\pi}{18}$, $-\dfrac{\pi}{9}$; y-intercept: $-\sqrt{3}$

(b) maximum point $= \left(\frac{5\pi}{36}, 2 \right)$, minimum point $\left(-\frac{\pi}{36}, -2 \right)$

(c) –

20. (a) $m = \frac{1}{4}$, $n = -3$, minimum

(b) x-intercepts: 0, 3; y-intercept: 0

(c) –