1. Find $f^{(22)}(x)$ if $f(x) = \cos(3x)$

2. Find $\dfrac{d}{dx} \displaystyle\int_x^{\pi/4} \sin(t)\cos(t)\,dt$

3. Find $\dfrac{d}{dx} \displaystyle\int_2^{x^2} \sin(t)\cos(t)\,dt$

4. Use Newton's method to find x_5 if $x_1 = 1$ for $x^3 - x^2 - 1 = 0$

5. Two cars start moving from the same point. One travels south at 60 mi/hr and the other west at 25 mi/hr. At what rate is the distance between the cars increasing two hours later?

6. If $c(x) = \dfrac{f(g(x))}{f(x)}$ find $c'(2)$ if $g(2) = 4$, $g'(2) = 4$, $f(2) = 1$, $f'(2) = -1$, $g(4) = 0$, $g'(4) = -3$, $f(4) = 3$ and $f'(4) = 2$

7. A kite 100 feet above the ground moves horizontally at a speed of 8 ft/sec. At what rate is the angle between the string and the horizontal decreasing when 200 feet of string has been let out?

8. Use implicit differentiation to find y' if $y = x + \sin(xy)$.

9. Find $\displaystyle\int_e^{e^2} \dfrac{dx}{x\ln(x)}$

10. Find $\displaystyle\lim_{x\to 2} \dfrac{|x-2|}{x-2}$

11. If the position of a particle is given be $s(t) = t^3 - 4.5t^2 - 7t$ for $t \geq 0$ when does the particle have velocity 5 m/s?

12. Use a linear approximation to estimate $f(1.2)$ for $f(x) = x^3 - x$

13. $\displaystyle\int \dfrac{\csc(\sqrt{t}-3)\cot(\sqrt{t}-3)}{\sqrt{t}}\,dt$

14. Find the x-values where $f(x) = x - 2\cos(x)$ has a horizontal tangent line on $[0, 2\pi]$

15. A solid has as its base the area bounded by $y = e^x$, $x = 0$, $x = 1$, and $y = 0$. Find the volume of the solid if every cross-section perpendicular to the x-axis is a square.

16. A rocket is fired directly up from the ground with initial velocity 64 ft/sec. What is the maximum height?

17. Find the most general antiderivative of: $\dfrac{(\ln(x))^2}{x}$

18. The area bounded by $y = 2x$ and $y = 2x^2$ is revolved around the x-axis. Set up the integral to find the volume generated.

19. Find y' if $y = x^{x^2}$

20. Find $\displaystyle\lim_{x \to -\infty} \dfrac{2x + 11}{\sqrt{x + x^2}}$

21. The area bounded by $y = x^{2/3}$, $y = 0$ and $x = 1$ is revolved around the y-axis. Find the volume generated using:

    (a) dy integration

    (b) dx integration

22. Set up the integral needed to find the surface area when $x = 4\sqrt{y}$ from $1 \le y \le 9$ is rotated around the x-axis.

Answers

1) $-(3^{22})\cos(3x)$

2) $-\sin(x)\cos(x)$

3) $2x\sin(x^2)\cos(x^2)$

4) $x_5 = 1.465955...$

5) 65

6) 11

7) $-\dfrac{1}{50}$

8) $y' = \dfrac{1 + y\cos(xy)}{1 - x\cos(xy)}$

9) $\ln(2)$

10) DNE

11) $t = 4$

12) 0.4

13) $-2\csc(\sqrt{t} - 3) + C$

14) $\dfrac{7\pi}{6}$ and $\dfrac{11\pi}{6}$

15) $\dfrac{1}{2}(e^2 - 1)$

16) 64

17) $\dfrac{1}{3}(\ln(x))^3 + C$

18) $2\pi \displaystyle\int_0^2 \left(\sqrt{\dfrac{y}{2}} - \dfrac{y}{2}\right) y\, dy$ OR $\pi \displaystyle\int_0^1 (2x)^2 - (2x^2)^2\, dx$

19) $y' = x^{x^2}(2x\ln(x) + x)$

20) -2

21a) $\pi \displaystyle\int_0^1 1 - (y^{3/2})^2\, dy$

21b) $2\pi \displaystyle\int_0^1 x(x^{2/3})\, dx$

22) $2\pi \displaystyle\int_1^9 y\sqrt{1 + \left(\dfrac{2}{\sqrt{y}}\right)^2}\, dy$