1. $\frac{1}{2}\int_0^{3/2}\frac{2dx}{\sqrt{9-4x^2}} = \frac{1}{2}\arcsin\frac{2(3/2)}{3} - \frac{1}{2}\arcsin\frac{2(0)}{3} = (\frac{1}{2}\arcsin 1 - \frac{1}{2}\arcsin 0) = (\frac{1}{2})(\frac{\pi}{2})$
$= \frac{\pi}{4}$ => **B**

2. $y = \frac{x}{\sqrt{x^2+7}}$ => $y^2 = \frac{x^2}{x^2+7}$ => $x^2y^2 + 7y^2 = x^2$ => $\frac{7y^2}{1-y^2} = x^2$ => $\frac{y\sqrt{7}}{\sqrt{1-y^2}} = x\ldots$
switch the x's and y's so that $f^{-1}(x) = \frac{x\sqrt{7}}{\sqrt{1-x^2}}$ => A = 7 and B = 1 => A + B = 8
=> **C**

3. Multiply both top and bottom by $\frac{1}{\sqrt{x^2}}$ and the limit = $\frac{-68}{\sqrt{6}} = \frac{-34\sqrt{6}}{3}$ => **E**

4. $6(x^2+y^2)(2x+2yy') = 100(xy'+y)$ …now plug in (3,1) and solve…
6(9 + 1)(6 + 2y') = 100(3y' + 1) =>360 + 120y' = 300y' + 100 =>180y' = 260 =>
y' = 26/18 = 13/9 => slope of normal = -9/13 and the equation of the line through (3,1) with slope -9/13 is 9x + 13y = 40 => **A**

5. $\frac{dy}{dx} = \frac{(4\cos^3 x)(-\sin x)}{(\ln 8)(\cos^4 x)} = \frac{-4\sin x}{(3\ln 2)(\cos x)} = \frac{-4\tan x}{3\ln 2}$ => **D**

6. 2x + 2y = M =>A = xy = $x(\frac{M-2x}{2}) = \frac{Mx-2x^2}{2}$ => $\frac{dA}{dx} = \frac{M}{2} - 2x$ …to find critical points we set equal to 0 => 0 = $\frac{M}{2} - 2x$ => x = $\frac{M}{4}$ and plugging into first equation above we get y = $\frac{M}{4}$ => maximum area = $(\frac{M}{4})(\frac{M}{4}) = \frac{M^2}{16}$ => **A**

7. $\lim_{x\to 0}\frac{16\sin(8x)\cos(8x)}{x} = \lim_{x\to 0}\frac{16\cos(8x)}{1}\bullet\frac{8\sin(8x)}{8x} = \lim_{x\to 0}\frac{16\cos(8x)}{1}(8)(1) = \lim_{x\to 0}(16\cos(8x))(8)$
$= 16(8)(\cos 0) = 128 \Rightarrow \text{E}$

8. $12.5\int_0^{\pi}\sin\theta d\theta = (12.5)(2) = 25$ => **A**

9. h' = fg' + gf' = $(|x^2-4|)(-|x|\sin x + \frac{x}{|x|}\cos x) + (|x|\cos x)(\frac{2x^3-8x}{|x^2-4|})\ldots$
note: $\frac{d(|u|)}{dx} = \frac{u'u}{|u|}$ …plugging in x = 1 => 3(-sin1 + cos1) + (cos1)(-2) =
cos1 – 3sin1 => **C**

10. Area = $\int_a^b (f(x) - g(x))dx$, where a and b are the x coordinates of the intersection

points of the curves, and f(x) is the top curve, and g(x) is the bottom curve. There are three intersection points and for [-1,0] f(x) is the top curve, but from [0,1] g(x) is the top curve, so to find the area you evaluate

Area = $\int_{-1}^{0}\left(4x^3-4x\right)dx+\int_{0}^{1}\left(4x-4x^3\right)dx = x^4-2x^2\Big|_{-1}^{0}+2x^2-x^4\Big|_{0}^{1}=1+1=2$.=>**C**

11. y' = $-3\sin 12t-4\cos 12t$ => at t = $\frac{\pi}{8}$ we get $-3\sin\frac{3\pi}{2}-4\cos\frac{3\pi}{2}$ = -3(-1) = 3 =>**A**

12. y' = $(2x\cos 2x-\sin 2x)(e^{\frac{\sin 2x}{x}})$ => y'(1) = (2cos2 – sin2)($e^{\sin 2}$) => **D**

13. V = $\frac{\pi r^2 h}{3}$ and $\frac{7}{10}=\frac{r}{h}$ => r = 7h/10 => V = $\frac{49\pi h^3}{300}$ => $\frac{dv}{dt}=(\frac{49\pi}{100})(h^2)(\frac{dh}{dt})$ =>
8 = $(\frac{49\pi}{100})(36)(\frac{dh}{dt})$ => $\frac{2}{9}=(\frac{49\pi}{100})(\frac{dh}{dt})$ => $\frac{dh}{dt}$ = $\frac{200}{441\pi}$ => **B**

14. Looking for critical points where f(x) is defined…on [8, ∞] we find none inside of the interval so, using the endpoint x = 8 we find that the point (8, 0) is the closest point on the graph to (2,0)…or simply draw the graph => sum = 8 => **A**

15. $\frac{\pi}{8}(\cos^2 0+2\cos^2\frac{\pi}{4}+2\cos^2\frac{\pi}{2}+2\cos^2\frac{3\pi}{4}+\cos^2\pi)=\frac{\pi}{8}(1+1+0+1+1)=\frac{\pi}{2}$ => **D**

16. L'hopital's rule => lim = $\lim_{x\to 1}\frac{\frac{6}{1+x^2}}{1}=\frac{\frac{6}{2}}{1}=3$ => **A**

17. By definition $e=\lim_{x\to\infty}(1+\frac{1}{x})^x$. This can be extended to show that
$e^{a/b}=\lim_{x\to\infty}(1+\frac{1}{bx})^{ax}$. So we get $e^{2/3}$ =>**C**

18. 1393/398 = 3.5 => $28(\frac{1}{2})^{3.5}$ = 28 $(\frac{1}{8})(\frac{\sqrt{2}}{2})$ = $\frac{7\sqrt{2}}{4}$ => **D**

19. Taking the natural log of both sides we get lny =ln$\frac{(x-2)^2}{\sqrt{x^2+1}}$ =>
lny = 2ln(x – 2) - $\frac{1}{2}\ln(x^2+1)$ => $\frac{y'}{y}=\frac{2}{x-2}-\frac{x}{x^2+1}$ =>
y' = $\frac{(x-2)^2}{\sqrt{x^2+1}}[\frac{2}{x-2}-\frac{x}{x^2+1}]$ => y'(0) = $(\frac{4}{1})(\frac{2}{-2})$ = 4(-1) = -4 => **A**

20. To find the minimum value of the second derivative, we must set the 3rd derivative equal to zero…y' = $4x^3+18x^2+4$, y'' = $12x^2+36x$, y''' = 24x + 36 => 0 = 24x + 36 => 24x = -36 => x = -3/2 (upon testing we find this to be a minimum) => y''(-3/2) = 12(9/4) + 36(-3/2) = 27 – 54 = -27 => **C**

21. f '(x) = $\frac{10}{3}x^{1/3}(x^{1/3}-2)$ and f ''(x) = $\frac{20(x^{1/3}-1)}{9x^{2/3}}$. The function has two critical numbers at x = 0 and x = 8 and two possible points of inflection at x = 0 and x = 1. The domain is all real numbers. f '(x) is positive and f ''(x) is negative on $-\infty < x < 0$, so (A) is true. Continuing the analysis in the same way, we find (B) and (C) to be true. Since f ''(x) is positive on $8 < x < \infty$, the graph is concave upward on that interval and (D) is false => **D**

22. Sum of squares from 1 to n is given by $\frac{n(n+1)(2n+1)}{6}$ …plugging in n = 16 gives $\frac{16(17)(33)}{6}$ = (8)(17)(11) = (88)(17) = 1496 => **B**

23. $\frac{1}{-1-(-3)}\int_{-3}^{-1}(x^2+6x+10)dx = \frac{1}{2}[\frac{x^3}{3}+3x^2+10x]$ evaluated from -3 to -1 = $\frac{1}{2}[(\frac{-1}{3}+3-10)-(-9+27-30)] = \frac{1}{2}(\frac{-22}{3}+12) = \frac{1}{2}(\frac{14}{3}) = \frac{7}{3}$ => **A**

24. $x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}$ and f '(x) = 6x. $x_2 = 1-\frac{2}{6} = \frac{2}{3}$ => $x_3 = \frac{2}{3}-\frac{1/3}{4} = \frac{2}{3}-\frac{1}{12} = \frac{7}{12}$ => **A**

25. $\frac{(1-\cos\theta)(\cos\theta)-(\sin\theta)(\sin\theta)}{(1-\cos\theta)^2} = \frac{\cos\theta-\cos^2\theta-\sin^2\theta}{(1-\cos\theta)^2} = \frac{\cos\theta-1}{(1-\cos\theta)^2} = \frac{-1}{1-\cos\theta}$ => **E**

26. $P = \frac{Tk}{V^2}$ => $P' = \frac{-2Tk}{V^3}$ => **C**

27. $= 6\int_0^{\frac{\pi}{6}}\sec x dx$ (note: we can eliminate the absolute value when removing from the radical because it's positive from 0 to $\pi/6$) = $6\ln|\sec x+\tan x|$ evaluated from 0 to $\pi/6$ = $6(\ln|\frac{2\sqrt{3}}{3}+\frac{\sqrt{3}}{3}|-\ln|1|)$ = $6\ln\sqrt{3} = 3\ln 3$ => **A**

28. The parrot population is growing fastest when the 1st derivative is at a maximum. So $P'(t) = \frac{200t(t^2+1) - 100t^2(2t)}{(t^2+1)^2} = \frac{200t}{(t^2+1)^2}$, then $P''(t) = \frac{200(t^2+1)^2 - 200t[2(t^2+1)(2t)]}{(t^2+1)^4} = \frac{200(t^2+1)[(t^2+1) - 2(2t)(t)]}{(t^2+1)^4} = \frac{200(-3t^2+1)}{(t^2+1)^3}$. P''(t) has a critical value when the numerator is 0 (the denominator cannot be 0 since setting it equal to 0 gives imaginary roots). So the critical values we get by setting the numerator equal to 0 are $t = \pm\sqrt{\frac{1}{3}}$. By the domain restrictions, the only possible t is $t = \sqrt{\frac{1}{3}} = \frac{\sqrt{3}}{3}$. Testing this value shows that this is in fact the value that maximizes P''. => **C**
29. $\frac{dy}{d(x^2-16x)} = \frac{dy/dx}{d(x^2-16x)/dx} = \frac{6x^2-30x-144}{2x-16} =$
$\frac{3x^2-15x-72}{x-8} = \frac{(x-8)(3x+9)}{x-8} = 3x+9$ => **C**
30. $A(x-5)+B(x+6) = x-27$. Plugging in x = 5 to eliminate A, we get 11B = -22 => B = -2 => **B**

1. B
2. C
3. E
4. A

5. D
6. A
7. E
8. A
9. C
10. C
11. A
12. D
13. B
14. A
15. D
16. A
17. C
18. D
19. A
20. C
21. D
22. B
23. A
24. A
25. E
26. C
27. A
28. C
29. C
30. B