1. –47
2. -2/π
3. 2/π
4. –12
5. –25/2
6. –1/20
7. π/3
8. $\frac{9\sqrt{3}-6}{\pi}$
9. 1/6
10. $\frac{\sqrt{2}}{4}$
11. 1
12. b, c, e
13. –1/5
14. 3π/112
15. $\frac{3\sqrt{2}}{2}$

1.
$$a = dv/dt = 2 + 6t$$
$$v = ds/dt = 2t + 3t^2 + 3$$
$$s = t^2 + t^3 + 3t + 2$$
$$A = s(1) = 1 + 1 + 3 + 2 = 7$$
$$a = 12, v = 12t, B = \int_0^3 v\,dt = \int_0^3 12t\,dt = 6t^2\Big|_0^3 = 54$$

A – B = 7 – 54 = – 47

2. $\lim\limits_{x\to 3}\dfrac{x-3}{x^2-2x-3} = \lim\limits_{x\to 3}\dfrac{1}{x+1} = 1/4$ so $\lim\limits_{x\to\infty}\dfrac{4-x^2}{4x^2-x-2} = -1/4$

$\lim\limits_{x\to -\infty}\tan^{-1}x = -\pi/2$ so $\lim\limits_{x\to\infty}\dfrac{3x^2+27}{x^3-27} = 0$ thus, $\dfrac{(AB)^D}{C} = \dfrac{(1/4 \bullet -1/4)^0}{-\pi/2} = -2/\pi$

3. **R** = 3cos(πt/3)**i** + 2sin(πt/3) **v = -**πsin(πt/3)**i** + (2π/3)cos(πt/3)**j**
**a =** $(-\pi^2/3)$cos(πt/3)**i** – $(2\pi^2/9)$sin(πt/3)**j**

A = v(3) = $\sqrt{(-\pi\cdot 0)^2 + (\frac{2\pi}{3}\cdot -1)^2}$ = 2π/3 B = a(3) = $\sqrt{(-\frac{\pi^2}{3}\cdot -1)^2 + (-\frac{2\pi^2}{9}\cdot 0)^2}$ = $\pi^2/3$

A/B = 2/π

4.
$$K'(1) = (\frac{1}{g})'(1) = -1\cdot\frac{1}{[g(1)]^2}\cdot g'(1)$$
$$= -1\cdot\frac{1}{3^2}(-3) = 1/3$$
$$M'(1) = f'(g(1))\cdot g'(1) = f'(3)g'(1)$$
$$= 4(-3) = -12$$
$$[f(x^3)]' = f'(x^3)\cdot 3x^2 \rightarrow P'(1)$$
$$= f'(1)\cdot 3 = 2\cdot 3 = 6$$
$$S'(3) = \frac{1}{f'(S(3))} = \frac{1}{f'(f^{-1}(3))} = \frac{1}{f'(1)} = 1/2$$
$$ABCD = 1/3 * -12 * 6 * 1/2 = -12$$

5. y = 4 – $x^2$
dy/dx = -2x = -2(1) = -2
y – 3 = -2(x-1)
y = -2x + 5 so the intercepts are (0, 5), (5/2, 0) and Area = ½ (5)(5/2) = 25/4

Let m = slope of line Equation of line: y – 2 = m(x –1) Intercepts: (0, 2 – m), (1 – 2/m, 0)
Area = ½ (2 – m)( 1 – 2/m) = ½ (4 – 4/m – m)
dA/dm = ½ $(4/m^2 - 1)$ = 0 m must be negative, so m = -2 AB = (25/4)(-2) = -25/2

6. $y = x^5 + x^3 - 2x$
$y' = 5x^4 + 3x^2 - 2$
$y'' = 20x^3 + 6x = x(20x^2 + 6) = 0,\ x = 0$
$y'(0) = -2$

$y = xe^{-x},\ y' = e^{-x}(1 - x) = 0,\ x = 1$

$y = x^4 - 4x^2$
$y' = 4x^3 - 8x$
$y'' = 12x^2 - 8 = 0$
the equation has two roots, and $y''$ changes sign at both
therefore the number of inflection points is 2

$f(x) = 4\sin x - 3\cos x$
$f'(x) = 4\cos x + 3\sin x = 0,\ \tan x = -4/3$
therefore, for the interval $[\pi/2, \pi]$
$\sin x = -4/5,\ \cos x = 3/5$
maximum value of $f(x) =$
$4(4/5) - 3(-3/5) = 5$

$1/(ABCD) = 1/(-2*1*2*5) = -1/20$

7.

$$A = \int_{-3}^{3} \frac{dx}{9 + x^2} = \frac{\tan^{-1}(x/3)}{3}\Big|_{-3}^{3}$$

$$= 1/3\left(\frac{\pi}{4} - -\frac{\pi}{4}\right) = \pi/6$$

$$\text{B} = \int_{1}^{e} \frac{\ln x}{x}\,dx = \frac{\ln^2 x}{2}\Big|_{1}^{e} = \frac{\ln^2 e}{2} - \frac{\ln^2 1}{2} = 1/2 \qquad \text{C} = \int_{0}^{1} xe^x\,dx = xe^x - e^x\Big|_{0}^{1} = 1$$

$A/(BC) = (\pi/6)/(1/2) = \pi/3$

8.

$$AV = \frac{1}{\frac{\pi}{2} - \frac{\pi}{3}} \int_{\frac{\pi}{3}}^{\frac{\pi}{2}} \cos x\,dx = \frac{6}{\pi}\sin x\Big|_{\frac{\pi}{3}}^{\frac{\pi}{2}}$$

$$= \frac{6}{\pi}\left(1 - \frac{\sqrt{3}}{2}\right) = \frac{3(2 - \sqrt{3})}{\pi}$$

$$AV = \frac{1}{\frac{\pi}{4} - \frac{\pi}{6}} \int_{\frac{\pi}{6}}^{\frac{\pi}{4}} \csc^2 x\,dx = -\frac{12}{\pi}\cot x\Big|_{\frac{\pi}{6}}^{\frac{\pi}{4}}$$

$$= -\frac{12}{\pi}(1 - \sqrt{3}) = \frac{12(\sqrt{3} - 1)}{\pi}$$

$$A + B = \frac{9\sqrt{3} - 6}{\pi}$$

9. x = 2cosθ and y = 3sinθ.

$\cos^2\theta + \sin^2\theta = 1$

$(x/2)^2 + (y/3)^2 = 1$

$A = \pi ab = \pi(2)(3) = 6\pi$

A = $\int_{-2}^{2} \frac{4}{x^2+4}dx = 2\tan^{-1}(x/2)\Big|_{-2}^{2} = \pi$

B/A = π/6π = 1/6

10.

$y\frac{dy}{dx} = x \rightarrow ydy = xdx$

$\frac{y^2}{2} = \frac{x^2}{2} + c \rightarrow c = 1/2$

$f(1) = \sqrt{2}$

$(dy/dx)^2 = y$

$dy/dx = \sqrt{y} \rightarrow \frac{dy}{\sqrt{y}} = dx$

$2\sqrt{y} = x + c \rightarrow c = 0$

$g(1) = 1/4$

$AB = \frac{\sqrt{2}}{4}$

11. A(x) = $\ln(\sec x + \tan x)$

A′(x) = $\frac{\sec x(\tan x + \sec x)}{\sec x + \tan x} = \sec x$

A′(0) = sec 0 = 1

B(x) = $e^{-x}\cos 2x$

B′(x) = $e^{-x}(-2\sin 2x) + \cos 2x(-e^{-x})$

B′(0) = -1

C(x) = $\sin^{-1} x - \sqrt{1-x^2}$

C′(x) = $\frac{1}{\sqrt{1-x^2}} - \frac{1\cdot(-2x)}{2\sqrt{1-x^2}}$

C′(0) = 1

A′(0) + B′(0) + C′(0) = 1 + -1 + 1 = 1

12. The p series $\sum \frac{1}{n^p}$ converges for p > 1 and diverges for p ≤ 1.

Therefore, b and c diverge, while a, d, and h converge

Alternating series converge if $u_{n+1} < u_n$ and $\lim_{n\to\infty} u_n = 0$. This condition is satisfied for series (f) and (g).

However, series (e) diverges because $\lim_{n\to\infty} u_n = 1$.

Thus, the series that diverge are (b), (c), and (e).

13.
$y = x^3$, $y' = 3x^2 = 3$, x = -1, 1
y – 1 = 3(x – 1) or y + 1 = 3(x + 1)
y = 3x – 2 or y = 3x + 2, k = -2, 2

$y = x^2$, $y' = 2x$
Equation of tangent is y – 5 = 2x(x – 3)
$x^2 – 5 = 2x(x – 3)$, x = 1, 5
slope = 2x = 2, 10

(AB)/(CD) = (-2*2)/(2*10) = -1/5

14.

$$A = \pi\int_0^\pi y^2dx = \pi\int_0^\pi (\sin x)^2 dx = \pi\int_0^\pi \frac{1-\cos 2x}{2}dx$$

$$= \pi(\frac{x}{2} - \frac{\sin 2x}{4})\Big|_0^\pi = \pi(\frac{\pi}{2}) = \pi^2/2$$

The equation of the line connecting the points (2, 2) and (4, 4) is y = x.

$$B = \pi\int_2^4 y^2dx = \pi\int_2^4 x^2dx = \pi\frac{x^3}{3}\Big|_2^4 = \pi(\frac{64}{3} - \frac{8}{3}) = \frac{56\pi}{3}$$

A/B = $(\pi^2/2) / (56\pi/3) = 3\pi/112$

15. f(x) = cos(x), f′(x) = -sin(x), f″(x) = -cos(x), f‴(x) = sin(x)
Coefficient = f‴(π/4)/3! = sin(π/4)/6 = $\sqrt{2}/12$

$y = e^{\sin x}$, $y' = \cos x(e^{\sin x})$, $y'' = (e^{\sin x})(\cos^2 x - \sin x)$
Coefficient = f″(0)/2! = 1/4

$$B/A = \frac{1}{4} / \frac{\sqrt{2}}{12} = \frac{3\sqrt{2}}{2}$$