

Question 1. Algebra

(a) Solve for x in $y = \frac{4x-1}{2x+3}$

(b) Solve for x in $y = x^6 - 1$

(c) Simplify: $\frac{2^n}{4^{n-1}}$

(d) Simplify:

$$\frac{\frac{(n+1)^2}{3^{n+1}}}{\frac{n^2}{3^n}}$$

(e) Complete the square: $x^2 - 3x + 5$

(f) One more complete the square: $2x^2 + 5x + 1$

(g) Solve $x^2 = 1$

(h) Solve $x^2 - 4x - 5 < 0$

(i) Solve $|x - 3| \leq 1$

(j) Solve $|2x - 1| \geq 3$

Question 2. Trigonometric functions

- (a) Sketch the graph of each of the six basic trig functions.
- (b) Use the graphs to find $\sin \frac{\pi}{2}$, $\sec 2\pi$, and $\tan(-\pi)$.
- (c) Use a method of your choice to evaluate $\sin(-\pi/3)$, $\cos(3\pi/4)$, $\tan 5\pi/3$, $\cot(-\pi/4)$, $\sec 2\pi/3$, and $\csc \pi$. (You may insert any special angles of your own.)

Question 3. Solve the following trig equations/inequalities on the interval $[0, 2\pi]$.

(a) $\tan x \leq \sqrt{3}$

(b) $2 \sin x = -2$

(c) $\csc^2 \theta > 2$

(d) $x + \tan^2 x = \sec^2 x$

Question 4. Write the sum below without a Σ :

$$\sum_{n=1}^4 \frac{1}{n^2}$$

Question 5. Calculus I. For each of the functions $f(x)$ below, find $f'(x)$.

(a) $f(x) = 3x^4 - 7x^2 + x - 1$

(b) $f(x) = (2x + 7)^{10}$

(c) $f(x) = 3x\sqrt[3]{1-x}$

(d) $f(x) = \frac{x+1}{x^2-7}$

Question 6. Find y' :

(a) $y = \cos(3x + 2)$

(b) $y = 5 \tan^2 x \sin x$

(c) $y = \sec x \tan(x^2)$

(d) $y = \frac{\cot x}{1-x^2}$

(e) $y = \csc(\sin^2(3x))$

Question 7. Find an equation for the line tangent to the curve $y = 2 \sec^2(3x)$ at $x = 0$.

Question 8. Use implicit differentiation to find $\frac{dy}{dx}$ if:

(a) $x^2 + xy - y^2 = 1$

(b) $\cos xy = 1 + y$

Question 9. Integral. Evaluate:

(a) $\int (x^3 - 2x^2 + 1)dx$

(b) $\int_0^1 (x^3 - 2x^2 + 1)dx$

(c) $\int \sqrt{t} dt$

(d) $\int (\sin \theta + \sec^2 \theta)d\theta$

(e) $\int_0^{\pi/3} (\sin \theta + \sec^2 \theta)d\theta$

Question 10. *u*-substitution

(a) $\int \frac{x}{(x^2-4)^3} dx$

(b) $\int \cos x \sin^3 x dx$

(c) $\int \frac{\csc(1+\sqrt{y}) \cot(1+\sqrt{y})}{\sqrt{y}} dy$

Question 11. Change your limits of integration on these!

(a) $\int_0^1 \frac{10\sqrt{v}}{(1+v^{3/2})^2} dv$

(b) $\int_{3\pi/2}^{\pi} \cot^5\left(\frac{\theta}{6}\right) \csc^2\left(\frac{\theta}{6}\right) d\theta$

(c) $\int_1^4 \frac{(1+\sqrt{x})^3}{\sqrt{x}} dx$

Question 12. Find the area bounded by the given curves.

(a) $y = x^2 - 2x + 1$ and $y = 4$

(b) $y = x(2x^2 - 1)^6$, the x -axis, $x = 0$, and $x = 1$

Question 13. Evaluate the following limits at infinity:

(a) $\lim_{x \rightarrow \infty} \frac{3x^5 - 2x^2 + 1}{2x^5 + 100x^4 - x}$

(b) $\lim_{x \rightarrow \infty} \frac{\sin x}{x^2 - 3}$

(c) $\lim_{x \rightarrow 0} \frac{\sin 2x}{x}$

Question 14. Calculus II. Evaluate:

(a) $\int \frac{1}{(x-1)(x-2)} dx$

(b) $\int \frac{2x}{x^2-5x+6} dx$

(c) $\int \frac{1}{(x-1)^2(x-2)} dx$

Question 15. Integration by parts!

(a) $\int x e^x dx$

(b) $\int x^2 e^x dx$

(c) $\int x \ln x dx$

(d) $\int e^x \sin x dx$