

Riemann Sums

1. True False Definite integrals are shorthand for Riemann sums.
2. True False The jumping constant definite integral law comes from the corresponding limit law.
3. True False A limit of Riemann sums depends on what method we use (Left endpoint, etc.).
4. True False The second derivative can tell us if the midpoint rule gives an over/under estimate.
5. Express $\lim_{n \rightarrow \infty} \left[\frac{2^2}{n^2} + \frac{2 \cdot 2^2}{n^2} + \cdots + \frac{2^2 n}{n^2} \right]$ as a definite integral from 0 to 2.
6. Express $\int_0^3 \cos^2(x) dx$ as a limit of right endpoint Riemann sums.

FTC

7. True False The crown of calculus is the fundamental theorem of calculus.
8. True False FTC I gives us an easy way to explicitly calculate definite integrals.
9. True False $\int_a^x e^{t^2} dt$ is an antiderivative of e^{x^2} .
10. True False FTC I and FTC II are not related.
11. Find an antiderivative of $e^{e^{x^2}}$ with $F(0) = 1$ (not necessarily in elementary functions).

U-Substitution/Integration by Parts

12. True False When integrating by parts, choosing different functions for u and dv (assuming both work out), will give different answers.
13. True False It is always good to u sub first in order to simplify the integral.
14. Find $\int_0^1 \sqrt{1 - \sqrt{x}} dx$.
15. Find $\int x^5 e^{x^3} dx$.

Numerical Integration

16. True False Numerical approximations are just approximations, and never the exact answer.
17. True False Simpson's method will approximate cubics exactly.
18. True False When calculating K_1 of $f(x)$ on $[a, b]$, we have that K_1 is the maximum of $|f'(a)|$ and $|f'(b)|$.
19. How many intervals do we need to use to approximate $\int_1^4 \ln x dx$ within $0.001 = 10^{-3}$ using Simpson's rule?

Differential Equations

20. True False We can determine the behavior of solutions of a differential equation without explicitly solving for them.
21. The rate at which an animal loses heat is proportional to its surface area (L^2). If the amount of heat an animal has is proportional to its volume (L^3), write this as a differential equation in terms of heat H .
22. The rate at which a person grows is proportional to his current height multiplied by his maximum height L minus his current height. Write this as a differential equation.

Separable Equations

23. True False When solving a separable equation, if we get that $ydy = xdx$, then the solution is $y = x + C$.
24. True False When solving a separable equation, we need to put the $+C$ immediately after integration.
25. Find the general solution to $\frac{dy}{dx} = e^{x-y}$.

Improper Integrals

26. True False We can compare an integral to $\int_1^\infty 1/\sqrt{x} dx$ in order to show it converges.
27. True False We can compare an integral to $\int_1^\infty 1/x^2 dx$ to show it diverges.
28. True False Since $x < x + 1$, we have that $\infty = \int_1^\infty \frac{1}{x} dx \leq \int_1^\infty \frac{1}{x+1} dx$ so the latter integral diverges.

29. Calculate $\int_{-\infty}^{\infty} \frac{1}{1 + (x - 1)^3} dx$.

Histograms

30. True False The height of each bar of a histogram represents the percentage of people that fall under that bin.
31. True False The bars of a histogram can have a height greater than 1.

PDFs/CDFs

See Worksheet 28.