

Math 189 – Extra Practice for Differentials

Calculate the differential dy for the following. (Recall that $dy = \frac{dy}{dx} dx$.)

1. $y = 3x^2$

2. $y = \sqrt{x}$

3. $y = \frac{1}{x}$

4. $y = \frac{1+x+x^2+x^3}{x^3}$

5. $y = \ln x$

6. $y = \sin x$

7. $y = \sin^2 x$

8. $y = \cos 2x$

Calculate the differential du for the following. (Recall that $du = \frac{\partial u}{\partial x} dx + \frac{\partial u}{\partial y} dy$.)

9. $u = x + y$

16. $u = x + y^2$

10. $u = x - y$

17. $u = x + 3y$

11. $u = xy$

18. $u = x \sin y$

12. $u = \frac{x}{y}$

19. $u = e^{xy}$

13. $u = \frac{y}{x}$

20. $u = \sqrt{x} - y$

14. $u = x^2 + y^2$

15. $u = x^3 y$

Answers

1. $dy = 6x dx$

2. $dy = \frac{dx}{2\sqrt{x}}$

3. $dy = -\frac{1}{x^2} dx$

4. $y = \frac{1+x+x^2+x^3}{x^3} = \frac{1}{x^3} + \frac{1}{x^2} + \frac{1}{x} + 1$ so $dy = \left(-\frac{3}{x^4} - \frac{2}{x^3} - \frac{1}{x^2}\right) dx = -\frac{3+2x+x^2}{x^4} dx$

5. $dy = \frac{dx}{x}$

6. $dy = \cos x dx$

7. $dy = 2 \sin x \cos x dx$

8. $dy = -2 \sin 2x dx$

9. $du = dx + dy$

15. $du = 3x^2 y dx + x^3 dy$

10. $du = dx - dy$

16. $du = dx + 2y dy$

11. $du = y dx + x dy$

17. $du = dx + 3dy$

12. $du = \frac{y dx - x dy}{y^2}$

18. $du = \sin y dx + x \cos y dy$

13. $du = \frac{x dy - y dx}{x^2}$

19. $du = e^{-xy} (y dx + x dy)$

14. $du = 2x dx + 2y dy$

20. $du = \frac{dx}{2\sqrt{x}} - dy$