

This review sheet is intended as a supplement to the text, your notes, and your graded papers. The lack of a particular type of problem on this review sheet does *not* mean that type of problem won't appear on the test.

**Evaluate the integral.**

$$1. \int \frac{x}{9} \tan\left(\frac{x}{9}\right)^2 dx$$

$$2. \int \frac{10x}{10x+5} dx$$

$$3. \int_0^{\pi/2} \sqrt{9-9\sin^2 \theta} d\theta$$

$$4. \int_0^1 \frac{6x^3}{3x^2+1} dx$$

$$5. \int_0^1 \frac{x}{\sqrt{x+1}} dx$$

$$6. \int \cos(\ln x) dx$$

$$7. \int (\sin x + \cos x)^2 dx$$

$$8. \int \frac{5e^{1/y}}{3y^2} dy$$

$$9. \int \frac{5 \ln x}{x} dx$$

$$10. \int \frac{dx}{x^2+2x+17}$$

$$11. \int \frac{2\sqrt{w}}{2\sqrt{w}} dw$$

$$12. \int \sin^5 x \cos x dx$$

$$13. \int e^t \cot(e^t - 3) dt$$

$$14. \int \frac{\cos(\ln x - 2)}{x} dx$$

$$15. \int 3x \operatorname{sech}(x^2) \tanh(x^2) dx$$

$$16. \int_2^3 \frac{x^5+1}{x^6+6x} dx$$

$$17. \int 9 \cosh\left(\frac{1}{2}x - \ln 3\right) dx$$

$$18. \int \frac{dx}{x(5+6 \ln x)}$$

$$19. \int \sin(2x) \sec x dx$$

$$20. \int \frac{2 \tan x}{\tan 2x} dx$$

$$21. \int \frac{\cos x}{1+2 \sin x} dx$$

$$22. \int 8 \sinh(4x - \ln 2) dx$$

$$23. \int \arccos x dx$$

$$24. \int_1^3 \ln 5x dx$$

$$25. \int x^3 \ln 3x dx$$

$$26. \int 7x e^x dx$$

$$27. \int 6x \sin x dx$$

$$28. \int_0^{\pi/6} \sin^3(9x) dx$$

$$29. \int 6 \cos^3(3x) dx$$

$$30. \int_{-\pi/8}^{\pi/8} \tan^4(2t) dt$$

$$31. \int (\sin 8x)(\cos 3x) dx$$

$$32. \int (\cos 4x)(\cos 2x) dx$$

$$33. \int_0^{\pi/2} \sin(7t) \sin(6t) dt$$

$$34. \int 7 \sec^4 x dx$$

$$35. \int_0^{\pi/2} \cos^2(2x) \sin^3(2x) dx$$

$$36. \int \frac{dx}{\sqrt{x}(\sqrt{x}-6)}$$

$$37. \int \frac{t^4+4}{t^5+20t+7} dt$$

**Find the value of the indicated hyperbolic function from the given information.**

$$38. \sinh x = \frac{5}{2}, \cosh x =$$

$$39. \sinh x = -\frac{4}{3}, \tanh x =$$

$$40. \cosh x = \frac{5}{3}, x > 0, \sinh x =$$

$$41. \cosh x = \frac{17}{15}, x < 0, \operatorname{csch} x =$$

Find a parameterization of the curve.

42. the line segment with endpoints (5,2) and (8,11)

43. the upper half of the parabola  $x - 1 = y^2$

44. the ray (half line) with initial point (-5,-9) that passes through the point (-8,-6)

Find an equation for the line tangent to the curve at the point defined by the given value of  $t$ .

45.  $x = t$ ,  $y = \sqrt{2t}$ ,  $t = 32$

46.  $x = t + \cos t$ ,  $y = 2 - \sin t$ ,  $t = \frac{\pi}{6}$

Find the length of the curve.

47.  $y = \int_1^x \sqrt{t^2 - 1} dt$ ,  $4 \leq x \leq 7$

Set up an integral for the length of the curve.

52.  $x = y^{1/7}$ ,  $0 \leq y \leq 2$

48.  $y = (16 - x^{2/3})^{3/2}$ ,  $1 \leq x \leq 64$

53.  $x = \sin 6y$ ,  $-\pi \leq y \leq 0$

49.  $x = \frac{y^4}{8} + \frac{1}{4y^2}$ ,  $1 \leq y \leq 2$

54.  $y = \int_0^x \cot \theta d\theta$ ,  $\frac{\pi}{6} \leq x \leq \frac{\pi}{3}$

50.  $x = 5e^t \sin t$ ,  $y = 5e^t \cos t$ ,  $0 \leq t \leq 1$

55.  $y = x^3$ ,  $0 \leq x \leq 1$

51.  $y = \ln(\csc x)$ ,  $\frac{\pi}{3} \leq x \leq \frac{\pi}{2}$

Find the area of the surface generated by revolving the given curve around the indicated axis.

56.  $x = t + 2\sqrt{3}$ ,  $y = \frac{1}{2}t^2 + 2\sqrt{3}t$ ,  $-2\sqrt{3} \leq t \leq 2\sqrt{3}$ ,  $y$ -axis

57.  $x = 5\cos^3 t$ ,  $y = 5\sin^3 t$ ,  $0 \leq t \leq 2\pi$ ,  $x$ -axis

58.  $y = \frac{1}{9}x^3$ ,  $0 \leq x \leq 2$ ,  $x$ -axis

59.  $x = 3\sqrt{4-y}$ ,  $0 \leq y \leq \frac{15}{4}$ ,  $y$ -axis

Set up an integral for the area of the surface generated by revolving the given curve around the indicated axis.

60.  $x = \int_0^y \sin t dt$ ,  $0 \leq y \leq \frac{\pi}{3}$ ,  $y$ -axis

61.  $xy = 3$ ,  $1 \leq y \leq 2$ ,  $y$ -axis

62.  $y = \cot x$ ,  $0 \leq x \leq \frac{\pi}{4}$ ,  $x$ -axis

Find the derivative with respect to  $x$ .

63.  $y = \cosh(x^6)$

64.  $y = -5x^3 \tanh\left(\frac{1}{x^2}\right)$

65.  $y = \ln(\operatorname{sech}(7x+10))$

66.  $y = \int_{x^8}^0 \cos \sqrt{t} dt$

67.  $y = \int_0^x \sqrt{4t+9} dt$

68.  $y = \int_1^{\sqrt{x}} 12t^9 dt$

69.  $y = \int_1^{5 \ln x} e^t dt$

Find the value of  $d^2y/dx^2$  at the given value of  $t$ .

70.  $x = \sin t$ ,  $y = 5 \sin t$ ,  $t = \frac{\pi}{3}$

71.  $x = 9t^2 - 6$ ,  $y = t^5$ ,  $t = 1$

**Solve the problems.**

72. Consider the area of the region in the first quadrant enclosed by the curve  $y = \frac{1}{6} \cosh 6x$ , the coordinate axes, and the line  $x = 7$ . This area is the same as the area of a rectangle with length  $s$ , where  $s$  is the length of the curve from  $x = 0$  to  $x = 7$ . What is the height of the rectangle?

73. The velocity of a body of mass  $m$  falling from rest under the action of gravity after  $t$  seconds is given by the equation  $v = \sqrt{\frac{mg}{k}} \tanh\left(t \sqrt{\frac{gk}{m}}\right)$ , where  $k$  is a constant which depends on the body's aerodynamic properties and the density of the air, and  $g$  is the gravitational constant. Find the limiting velocity (the *terminal velocity*)  $\lim_{t \rightarrow \infty} v$  of a 230 lb. skydiver ( $mg = 230$ ) when  $k = .006$ .

74. A bathroom scale is compressed  $\frac{1}{4}$  inch when a 72.5 kg person stands on it. Assuming that the scale behaves like a spring which obeys Hooke's Law, how much does someone weigh who compresses the scale  $\frac{1}{8}$  inch?

75. Suppose that  $\int_1^x f(t) dt = 6x^2 + 9x - 2$ . Find  $f(x)$ .

76. It took 1920 J of work to stretch a spring from its natural length of 3m to 5m. Find the spring's force constant.

77. A rocket follows a path described by  $y = \frac{2}{3}(x^2 - 1)^{3/2}$ . Find the distance the rocket travels for  $3.7 \text{ km} \leq x \leq 4.1 \text{ km}$ .

78. Find a curve which passes through the origin and whose length from  $x = 0$  to  $x = 1$  is  $L = \int_0^1 \sqrt{1 + \frac{1}{36}e^x} dx$ .

79. Find  $f(\pi)$  if  $\int_0^x f(t) dt = x \sin(4x)$ .

80. A rescue cable attached to a helicopter weighs 2 lb/ft. A 190 lb man grabs the end of the rope and is pulled from the ocean into the helicopter. How much work is done in lifting the man if the helicopter is 50 ft above the water?

81. The gravitational force of attraction (in lb) between two objects is given by  $F = kx^{-2}$ , where  $x$  is the distance between the objects and  $k$  is a constant. If two objects are 5 ft apart, find the work required to separate them until they are 75 ft apart. Express the result in terms of  $k$ .

82. Find the area between  $y = (x - 2)e^x$  and the  $x$ -axis from  $x = 2$  to  $x = 6$ .

83. The voltage  $v$  (in volts) induced in a tape head is given by  $v = t^2 e^{3t}$ , where  $t$  is time in seconds. Find the average value of  $v$  from  $t = 0$  to  $t = 3$ . Round to the nearest volt.

84. Find the volume generated by revolving the curve  $y = \cos 2x$  about the  $x$ -axis,  $0 \leq x \leq \pi/24$ .

85. A plane averaged 300 mph on a 600 mile trip, then returned over the same 600 miles at 400 mph. What was the plane's average speed for the entire trip?

**Use integration by parts to establish a reduction formula for the integral.**

86.  $\int \sec^n x dx$ ,  $n \neq 1$

87.  $\int \sin^n x dx$

88.  $\int x^n e^x dx$