AP Calculus HW ch 1 – 2.4

Online help for odd numbered exercises
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1.1 p. 47 intro to limits: motion, area and tangent lines: # 1--9

1.2 Graphical and Numerical Limits p. 54
Use 2nd→CALC→value for # 1, 3, 7, then do # 9–19 odd, 20–24, 53–55

1.3 Evaluating Limits Analytically p.67
A.: # 3, 4,15–25 odd, 27–30, 37–40, 41--61 odd

B. more algebraic limits # 42–48 even, 50–62 even
C. trig functions # 67-72 also find $\lim_{x\to 0}\frac{2\sin 3x}{\sin 2x}$
D. More trig # 73-78 and $\lim_{x\to 0}\frac{\sin 4x}{\sin 6x}$, $\lim_{x\to \frac{\pi}{4}}\frac{\sin 2x}{\sin 3x}$
E Difference quotient # 83-86, 113-116

1.4 Continuity and One-Sided Limits, Intermediate Value thm p. 78
1-13, 15–18, 25–27, 30, 31, 33, 37, 41, 42, 44–46, 59, 60, 75–78 (sketch the graphs), 83, 84

1.5 Infinite Limits (vertical asymptotes) p. 88
1, 2, 5–8, 9–14, For V–asymptotes, use a sign pattern to determine whether y $\to\infty$ or y $\to -\infty$. Confirm with a calculator graph (sketch). # 29–31. Use algebra (no calculators) #33–47

Rvw 1 ***be ready for a test on ch 1 soon*** p. 91 # 1, 3, use algebra for # 11-25 odd, 26, for # 27 rationalize by multiplying by $\frac{\sqrt{2x+1}+\sqrt{3}}{\sqrt{2x+1}+\sqrt{3}}$ then do # 29, 30, 33, 34, 38, 39, 41, 48, 49, 51, use sign patterns to do 57-60 and verify with a graph. **Problem Solving** p.93 # 4, 9

2.1 Tangent line slopes, Definition of Derivative, Differentiability p. 103
A. # 1, 2, use numerical derivative (MATH or CALC menu) for #5-8. Do #11, 13, 17.

B. Write the limit-expression for dy/dx for the following, also write a limit-expression for f $'$(3) in each case. You do not need to evaluate the limits:

i. f(x) = sin x
ii. f(x) = $e^x + 2$
iii. f(x) = $\sqrt{x^2-4}$
iv. f(x) = e^{x+2}

C.dentify the function whose derivative is expressed by the following:

v. $\lim_{h\to 0}\frac{(x+h)^2-x^2}{h}$ = f $'$(x) What function is f(x) ?
vi. $\lim_{h\to 0}\frac{\ln(e+h)-\ln(e)}{h}$ = f $'$(??) What function is f(x) ?
vii. $\lim_{x\to a}\frac{\cos x-\cos a}{x-a}$ =f $'$(??) What function is f(x) ?

D. # 37–46, 59
E. alternate form $\lim_{x\to c}\frac{f(x)-f(c)}{x-c}$: # 71, 76, 79
F. differentiability: # 83–86, 93–96

2.2 Basic Differentiation Rules and Rates of Change (shortcuts!) p.115
A. # 1, 2, 3–17 odd, 25, 28, 29, 33-35
B. more derivatives: #4-18 even, 26, 30, 39-42 also do #113
C. tangents #53-56, 58-60, 63, 65, 66

D. trig derivatives: #19-24, 37, 38, 51, 52, 61, 62 and 114
E. average rate of change: #90, 91
F. motion: #93-100 and finish 2005AB5 (extension) handout

2.3 Product, Quotient rules & Higher-Order Derivatives p. 126
A. product rule: Always write the product rule in symbols first then substitute. For # 1–4 use the product rule to find the derivative, then check your answer by multiplying function out and using the polynomial rule. Also do 5, 6, 13, 14 and 17, 27, 28, do 63, 64 analytically and check with a calculator

B. quotient rule: # 7-12, 15, 16, 18, 19-21, 25, 26, 29.

C. more practice: # 31-47 odd, 65, 68, 73, 75, 77, 79, 81, 82, 93–113,
D. acceleration, the derivative of velocity: #115, 116, 136, 137, 138

2.4 Chain Rule p. 137
A. chain rule: # 1-6, 7-19 odd, 41-47 odd, 59, 61
B. more chain rule # 63, 65, 67-73 odd, 83-86, 110, 111, 112, 122
C. do without a calculator:

Let f(x) = $\sqrt{1-\sin x}$
(a) What is the domain of f?
(b) find f $'$ (x)
(c) What is the domain of f $'$?
(d) Write an equation for the line tangent to the graph of f at x = 0.

D. Extra Chain Rule Practice # 21-31 odd, 47-59 odd

Quiz 2.1-2.4

AP Calculus HW 2.4 – 3.4

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2.5 Implicit Differentiation p. 146
A. # 1-12, 17, 18, 22, 23, 28, 34, 36, 39
B. No Calculator: ***Consider the curve $x^2 + xy + y^2 = 27$***
(a) Write an expression for the slope of the curve at any point (x, y)
(b) Determine whether the lines tangent to the curve at the x-intercepts are parallel. Show the analysis that leads to your conclusion
(c) Find the points on the curve where the lines tangent to the curve are vertical

C. second derivative # 45-48
D. *No Calculator:* ***Consider the curve defined by the equation $y + \cos y = x + 1$ for $0 \le y \le 2\pi$***

(a) Find $\frac{dy}{dx}$ in terms of y
(b) Write an equation for each vertical tangent to the curve
(c) Find $\frac{d^2y}{dx^2}$ in terms of y.

E. normal lines are perpendicular to tangent lines: # 53-55, 80a.
F. No Calculator: ***Let f be the function given by***
$f(x) = \sqrt{x^4 - 16x^2}$
(a) Find the domain of f.
(b) Describe the symmetry, if any, of f.
(c) Find $f'(x)$
(d) Find the slope of the line <u>normal</u> to the graph of f at x = 5.

2.6 Related Rates (Handout from ANTON)
A. p. 154 # 16, 18, 19, 20, 21, 27, 31, 39 and from the handout # 7, 8, 11, 13

B. p. 154 # 22, 23, 24, 30, 32, 33, 43, 45, 48 and from the handout # 14, 16, 21, 22

C. p. 154 # 34 and from the handout # 15, 17, 20, 25, 26, 27, 29, 30, 31, 33

D. No Calculator The radius r of a sphere is increasing at a constant rate of 0.04 centimeters per second. (note: volume of a sphere with radius r is given by $V = 4/3\ \pi r^3$
(a) At the time when the radius of the sphere is 10 cm, what is the rate of increase of its volume?
(b) At the time when the volume of the sphere is 36π cubic centimeters, what is the rate of increase of the area of a cross section through the center of the sphere?
(c) At the time when the volume and the radius of the sphere are increasing at the same numerical rate, what is the radius?

Rvw 2 p. 158 Be ready for a test on chapter 2 soon
Write two forms for the limit expression of dy/dx for # 2, 4, and write limit expressions for $f'(2)$ in each case. Use NDER to find the equation of the tangent line at x = 2, then do # 5, 6, 8, 11, 14, 39, 41– 55 odd, 61-67odd, 68, 101, 105, 110, 111, 112, **Problem Solving** p.161 # 14

Test ch 2

3.1 Extreme Value Theorem p. 169
1–12, 14, 16, 23–26, 39, 40, 55–60

3.2 Rolle's and Mean Value Thm p.176
A. # 1, 2, show algebra for # 11, 13, 29, 30–34 show algebra for #37, 39, 40, 42, 43, 51-54, 57, 69
B No Calculator
Let f be the function given by $f(x) = x^3 - 7x + 6$
a. find the zeros of f
b. write an equation of the line tangent to the graph of f at x = –1
c. Find a number c that satisfies the conclusion of the Mean Value Theorem for f on the closed interval [1, 3]

3.3 Increase, Decrease and First Derivative test p. 186
A. # 5-8, 21, 23, 27, 29, 34, 39, 43, 55–64, 76, 79, 86, 88, 89
B. No Calculator:
Let f be the function defined by $f(x) = \sin^2 x - \sin x$ for $0 \le x \le \frac{3\pi}{2}$
(a) Find the x-intercepts of the graph of f
(b) Find the intervals on which f is increasing
(c) Find the absolute maximum value and the absolute minimum value of f. Justify your answer.

3.4 Concavity and Second Derivative test p. 195
A. # 1-6, 11, 14, 18, 20, 27, 30, 35, 36, 38, 39, 45-56
B. No Calculator: *Let h be a function defined for all nonzero x such that h(4) = -3 and the derivative of h is given by*
$h'(x) = \frac{x^2 - 2}{x}$ *for all non zero x*
(a) Find all values of x for which the graph of h has a horizontal tangent, and determine whether h has a local maximum, a local minimum, or neither at each of these values. Justify your answers.
(b) On what intervals, if any, is the graph of h concave up? Justify your answer.
(c) Write an equation for the line tangent to the graph of h at x = 4
(d) Does the line tangent to the graph of h at x = 4 lie above or below the graph of h for x > 4 ? Why?

Be ready for a quiz on 3.1-3.4

AP Calculus HW 3.5 – 4.4

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3.5 Limits at infinity (horizontal asymptotes) p. 205
A. Use the CALC menu for: # 9, 11, no calculators for #13, 15, 16, 18, 21–32, 57, 61
B. No calculator: *Let f be the function given by*

$$f(x) = \frac{2x}{\sqrt{x^2 + x + 1}}$$

(a) Find the domain of f. Justify your answer.
(b) Sketch a complete graph of f.
(c) Write an equation for each horizontal asymptote of the graph of f.
(d) Find the range of f. Use $f'(x) = \frac{x+2}{(x^2+x+1)^{3/2}}$ *to justify your answer.*

3.6 Summary of Curve Sketching p.215
1-6, 8, 16, 20, 27, 30, 32, 47-52

ANTON Motion handout To make a derivative graph, use nder (function , x , x). For the function you can use VARS-y-vars→function→ Y1 to graph a derivative without an explicit expression.
Part A (faster & slower) quick check # 1-4, hw #1-4, 6-9, 11. On # 13, 14do parts a-d only.
Part B (total distance, max speed) #13& 14 part e, 19, 21-25, 27, 30, 32, 33 do # 25 with a calculator

3.7 Optimization (maximizing/minimizing) p.223
Always use calculus unless otherwise specified.
A. # 2, 3, 4, 9, 10, 11, 12
B. # 13, 16-21
C. # 23, 28, 30, 49, 50

3.8 Newton's method is not an AP test topic. We skip this section for now and come back to it after the AP test

3.9 Differentials and tangent line approximations p. 240
A. #1-10, 27, 28, 32 then write your own functions and use linear approximations to estimate $\sqrt{10}$ and $\sqrt[3]{7}$
B. No calculator: *Let f be the function defined by*

$$f(x) = (1 + \tan x)^{3/2} \quad \text{for} \quad -\tfrac{\pi}{4} < x < \tfrac{\pi}{2}$$

(a) Write an equation for the line tangent to the graph of f at the point where x = 0.
(b) Using the equation found in part (a), approximate f(0.02).
(c) Let f^{-1} denote the inverse function of f. Write an expression that gives $f^{-1}(x)$ for all x in the domain of f^{-1}.

C. No Calculator
Consider the curve defined by $-8x^2 + 5xy + y^3 = -149$
(a). Find dy/dx
(b). Write an equation for the line tangent to the curve at the point (4, –1)
(c). There is a number k so that the point (4.2, k) is on the curve. Using the tangent line found in part (b), approximate the value of k.
(d) Write an equation that can be solved to find the actual value of k so that the point (4.2, k) is on the curve.
(e) Solve the equation found in part (d) for the value of k.

Rvw 3 p. 242 be ready for a test on chapter 3
#6, 7, 8, 11–13, 16–28, use calculus only for # 50, 51, 57, 60, 69, 71. Also use calculus to prove that if a farmer builds a fence of length L along three sides of a garden (the fourth side is along the barn wall) then the maximum area occurs when the garden measures (¼ L) by (½ L).
F. Use a tangent line to approximate $\sqrt[3]{9}$

Test ch 3

4.1 Antiderivatives and Indefinite integration p. 255
A. # 1-17 odd, 22, 27–37odd, 44, 45, 49-52. For 53 sketch the slope field by hand on a small grid.
B. #55-61 odd, 64, 67, 68, 75, 81

Slope field packet

4.2 Area p. 267
2-5, 8-10, 23-29 odd, 63

4.3 Riemann Sums and Definite Integrals p. 278
For # 5, 6, only write the integral in its limit form, then do # 9-12, # 13-21odd, 23, 25, 27, 32–37, 41, 45, 47, 49

4.4 Fundamental Theorem of Calculus p. 291
A. Sketch graphs for # 1-4 then do 7–13 odd, 27-29, 38, 40, 43-47, 49, 51, 52-60

B. FTC part 2 # 67–73 odd, , 74, 75–93odd

C. Motion handout dist & s(t) from v(t) **Quick check #1-4, exercises # 1-4, 6-16 even, use a calculator to do # 20, then do 29, 41, 43)**

D No calculator. **A particle moves along the x-axis so that its acceleration at any time t is given by a(t) = 6t – 18. At time t = 0, the velocity of the particle is v(0) = 24, and at time t = 1, its position is x(1) = 20**
(a) Write an expression for the velocity v(t) of the particle at any time t.
(b) For what values of t is the particle at rest?
(c) Write an expression for the position x(t) of the particle at any time t
(d) Find the total distance traveled by the particle from t = 1 to t = 3.

Quiz 4.1-4.4

AP Calculus HW 4.5 – 7.2

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4.5 Integration by Substitution p. 304
A.: #1-6, 7-23 odd, 35, 37, 39, 41, 43-46, 50, 71-81 odd, : 83–91 odd 109, 131

B. No calculator ***Let f be the function that is defined for all real numbers x and that has the following properties:***

(i) $f''(x) = 24x - 18$
(ii) $f'(-1) = -6$
(iii) $f(2) = 0$

(a) Find each x such that the line tangent to the graph of f at (x, f(x)) is horizontal
(b) Write an expression for f (x)
(c) Find the average value of f on the interval [1, 3].

4.5 C. ***No Calculator A cubic polynomial function f is defined by $f(x) = 4x^3 + ax^2 + bx + k$ where a, b, and k are constants. The function f has a local minimum at x = –1 and the graph has a point of inflection at x = –2.***

(a) *find the values of a and b.*

(b) if $\int_0^1 f(x)dx = 32$ *what is the value of k?*

4.6 Numerical Integration (Trapezoid Rule) p. 314
A. Use trapezoid rule only for# 1-4, 21, 39, 40, 48, 52

B. No Calculator *Let* $F(x) = \int_0^x \sin(t^2)dt$ *for* $0 \le x \le 3$

(a) Use the trapezoid rule with four equal subdivisions on the closed interval [0, 1] to approximate F(1)
(b) On what intervals is F(x) increasing?
(c) If the average rate of change of F on the closed interval [1, 3] is k, find $\int_1^3 \sin(t^2)dt$ *in terms of k.*

Rvw 4 p. 316
1, 2, 4-7, 11, 12, use calculus to do # 13, 14. Then do # 25– 27, 35 – 38, 42–46, 49, 50, do #54 with fnInt (MATH 9:) and again using the calc menu of your calculator graph.
Then do : # 63-67, 71, 73-77, 89-90, and use trapezoid rule only: # 95, also do **Problem Solving: p. 319** # 7, 10

5.1 Natural Logarithmic Function: Differentiation p. 329
A. # 19-33 odd, do 37 without a calculator. Do #45-52, 69, 70, 76, 80, 84, 93-96
B. extra practice: # 53-60, 74, 86, 88, 97, 98

C No Calculator: A particle moves along the x-axis so that at any time t >0, its velocity is given by **v(t) = t ln t – t.** At time t = 1, the position of the particle is x (1) = 6
a. Write an expression for the acceleration of the particle
b. For what values of t is the particle moving to the right?
c. What is the minimum velocity of the particle? Show the analysis that leads to your conclusion.

5.2 Natural Logarithmic Function: Integration p.338
1-25 odd, 29-34, 43–53 odd, 61-64

5.3 Inverse Functions p.347
#1, 5, 11-17 odd, 18, 25-28, 41–43, 81, 82, 101-104
Use the chain rule to prove theorem 5.9

5.4 Exponential Functions: Differentiation and Integration p.356
A. Solve symbolically first (without a calculator) then compare decimal answers for : # 1, 2, 5, 9, 10, then do # 31, 32, 35-41, 45-48, 50, 51, 57-61, 85-90, 99-102

5.5 Bases Other Than e **p. 366**
A. # 1-8, 19-22, 29, 30, 37-39, 45-47, 49, 50, 55-58, 61-73 odd
B. # 40-44, 48, 51-54, 59, 60, 62-74 even, 82, 86, 92, 108, 109

Test 5.1-5.5

5.6 Inverse Trig Functions and Derivatives p. 377
Use $\sin^{-1}$, $\cos^{-1}$ notation for # 3-12, Then do #17-28 (draw a triangle as in example 3 where appropriate) Use algebra to solve: # 31-34
Also do # 41-52, 63, 65, 73, 75, 79-92
5.7 **Integrals Involving Inverse Trig Functions** p. 385 # 1-35 odd, 53-57 odd

Rvw 5.1-5.5 p. 399 # 3–12,15–21 odd, 22, 25, 27, 31, 32, 35, 39-45 odd, 47, 48, 49-59 odd, 65-69 odd

Rvw 5.6-5.7 p. 400 # 77, 78, 79, 81, 85-89odd

6.1 Slope Fields (and Euler's Method) p. 409
1, 2. For # 11, 12 verify that the given function is a solution to the differential equation, and then verify that it is the particular solution that goes through the given point. Then do 15, 20, 25, 33, 34, 37 – 43, 49, 50, 53 – 56. For 57 & 59 make a table of integer values of x and y near the given point and sketch the slope field by hand for nine (x, y) pairs.

Test on ch 5

6.2 Differential Equations: Growth and Decay p. 418
1, 3, 11 – 21 odd, 22, 26, 33 – 38, 43 – 45, 62, 63

6.3 Separation of Variables p. 429
1-11 odd, 13-16, 23, 24, 45 – 47

Rvw 6.1-6.3 p. 441 # 1, 3, 5, 9, 11, 13, 23, 25, 27, 41, and solve $\frac{dy}{dx} = ky$ showing your solution must be $y = y_o e^{kt}$

7.1 Area Between Curves p. 452
A. # 2, 3, 4, and write a second integral for # 5 making use of symmetry. Then do # 13, 14, 21, 22, 23, 26, 27, 28, 33, 43, 44, 57, 58 and use the trapezoid method only for # 65

B. # 5, 6, 7, 9, 11, 17, 25, 29-32, 35-41 odd, 45-51 odd,71, 72, 73, 75, 78,

Test on chapter 6

7.2 Volume: the Disk (and Washer) Method p. 463
A. # 3– 8, do # 11-14 analytically, do with a calculator.#17, 20, 21-41 odd, 45, 48, 49-53, 57
B. Known cross sections # 61-63
C. Handout

7.2 PROJECT— Invent a 3-dimensional solid to find its volume. Write up your problem as if it is a text book example. Also build a physical Riemann sum to model your work. Your building and writing should incorporate the following:

a) You will describe and sketch a non-linear relation in the x-y plane, the cross section's geometric shape and dimensional limits. Each unit on your graph must represent one centimeter. Your description should use our homework exercises as a guide, and leave no room for ambiguity.

b) Calculate the estimated **volume** of your model, using a Riemann Sum with at least 10 partitions.

c) Using household or craft store materials (foam core, corrugated paper, sponge, styrofoam, cardboard, etc. and glue) build a model of your Riemann sum that matches the **estimated volume** of your solid, as calculated above. One unit in your description/drawing MUST equal one centimeter in your physical model. Do not ask me to make an exception for you.

d) Use calculus to find the **exact** volume of the solid you have described.

e) Show your conceptual understanding. Tell how each part of your project relates to the other parts.

7.2 Project score

1) Volume Communication: Clear description with no room for ambiguity:
   a) _____(4) Boundaries of base region
   b) _____(2) Cross section orientation
   c) _____(2) Cross section geometric shape
   d) _____(2) How cross section fits base boundaries
   e) _____(5) Use of conventions, neat, well formatted & readable.

2) Volume Estimation: work shown includes
   a) _____(5) Sketch of volume estimate
   b) _____(5) Model has at least ten partitions
   c) _____(5) Model fits description
   d) _____(5) Model size fits scale of sketch
   e) _____(5) Work shows individual partition volumes and sum.

3) Calculus
   a) _____(10) Appropriate integral expression
   b) _____(5) Estimate is reasonably close to calculus

4) _____(20) Conceptual understanding

_____(75) total

Chapter 7 test

7.3 shells Skip until after AP test
7.4 arc length Skip until after AP test
7.5 work Skip until after AP test
7.6 moments, center of mass Skip until after AP test
7.7 fluid force Skip until after AP test

8.7 l'hopital's rule

3.8 p. 233
Newton's method # 1-4, 21, 22, 41, 42, 44

Write your own function and initial guess to find $\sqrt{10}$ and $\sin\frac{\pi}{4}$ accurate to eight decimal places. Check with a calculator value

AP Calculus after the AP test homework smorgasbord

8.1 rules of integration p. 522

A. Review of substitution # 1-21 odd, 25-29 odd

B. Tricks of the trade: # 35-49 odd

8.2 integration by parts p. 531 # 1-21 odd, 25, 29, 35, 47-53 odd

Test on 5.6, 5.7, 8.1, 8.2

8.7 l'hopital's rule p. 574
1-17 odd, 18, 20, 21, 27, 33-39 odd

3.8 Newton's method p. 233
1-4, 21, 22, 41, 42, 44 Write your own function and initial guess to find $\sqrt{10}$ and $\sin\frac{\pi}{4}$ accurate to eight decimal places. Check with a calculator value.

Proof by induction handout with exercises

Test

7.3 Shell method for volumes p. 472 # 1, 3, 7, 15, 21, 25, 26

7.4 arc length p. 483 # 3, 5, 7, 11, 15, 17, 33
and **surface area** p. 484 # 39, 40, 43, 44, 45, 51, 52

7.5 work p. 493

A. Concepts # 1, 3, 5- 8,

B. Springs # 9, 11, 13, 15

C. propulsion # 17-20

D. Pumping Fluids # 21-27 odd

E. Lifting a chain # 31-34, 37

7.6 moments, center of mass p. 504 all exercises are optional. The next test will have an extra credit problem from this section.

7.7 fluid force p. 511 # 5-17 odd, 18, 34

Test on applications of integration (with calculators)