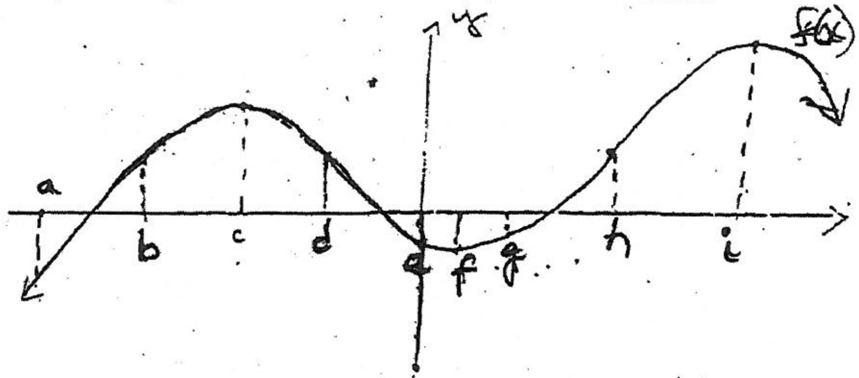
DERIV. APPLICATION PRACTICE

1. Use the figure given to complete the chart by indicating whether the functions are +, -, or 0 at the indicated points.

	f(x)	f'(x)	f''(x)
a			+
b			
c			
d			
e			
f			
g			
h			
i			



For each #2 – 5, identify all extrema, where the function is increasing and decreasing, concave up and down, and all x values of points of inflection.

2. $f(x) = x^2 - 8x + 3$ 3. $f(x) = x^3/3 + x^2 - 3x + 1$ 4. $f(x) = \cos(x/2)$ on $[0, 2\pi]$

5. $f(x) = 1/(x-1)^2$

6. Find the number that exceeds its square by the greatest possible amount.

7. An open box is formed from a square piece of tin 10 inches on a side by cutting congruent squares from the corners and turning up the flaps. Find the maximum volume of such a box.

8. Find the least amount of lumber that will be needed to form an open box with a square base and a capacity of 32 ft^3.

9. A manufacturer can ship a cargo of 200 tons at a profit of $10 per ton. However, by waiting can add 10 tons per week to the shipment, but the profit on the entire shipment will be reduced $.20 per ton per week. When should the shipment be made in order to realize maximum profit?

10. Find the dimensions of the largest cylinder that can be cut from a solid sphere of radius a.

11. A triangle is formed in the coordinate plane by joining the points (0,1) and (8, 0). A rectangle is drawn inside the triangle with one vertex at the origin and its opposite vertex on the hypotenuse. What is the largest possible area of such a rectangle?

12. An object is hurled directly upward and its height above the ground is given by $s(t) = 64t - 16t^2$, where s is measured in feet and t in seconds.
    a) When does the object reach its highest point?
    b) What is the velocity when it hits the ground?
    c) How far has it traveled when it hits the ground?

13. A particle moves along a line according to $s(t) = 2t^3 - 9t^2 + 12$, where s(t) is distance in feet from the origin after t seconds. Find a) the velocity at $t = 2$ b) the acceleration at $t = 1$ c) describe the motion of the particle.

14. A particle moves along a line according to $s(t) = t^4 - 4t^3 - 8t^2 + 2$, where s(t) represents distance in feet from the origin after t seconds. Find a) the average velocity on the interval [0,2] b) at what time(s) the particle is at rest.

15. If $s(t) = 2t^3 - 6t^2 - 3t$ describes the motion of a particle on a line, find the maximum and minimum *velocities* on the interval [0, 3].

16. A cube is compacted so that the volume decreases at a rate of 2 m^3 per minute.
    a) Find the rate of change of an edge of the cube when the volume is 27 m^3.

ANS.

1.

	f(x)	f'(x)	f''(x)
a	−	+	+
b	+	+	−
c	+	0	−
d	+	−	0
e	−	−	+
f	−	0	+
g	−	+	+
h	+	+	0
i	+	0	−

2. min. $(4,-13)$
$\uparrow (4,\infty)$ $\downarrow (-\infty,4)$
c.u. $(-\infty,\infty)$
no poi

3. max $(-3,10)$
min $(1,\frac{-2}{3})$
$\uparrow (-\infty,-3)\cup(1,\infty)$
$\downarrow (-3,1)$
cup $(-1,\infty)$ cd. $(-\infty,-1)$
poi: $x=-1$

4. $\downarrow (0,2\pi)$ $\uparrow$ never
$f(0)=1$ abs max
$f(2\pi)=-1$ abs min
cup $(\pi,2\pi)$ cd. $(0,\pi)$
$x=\pi$ poi.

5. $\uparrow (-\infty,1)$ $\downarrow (1,\infty)$
no extrema
c.u. $(-\infty,1)\cup(1,\infty)$
cd never no poi

6. $n=\frac{1}{2}$ 7. $74.1\ in^3$ 8. $48\ ft^2$

9. delay 15 wks 10. $r=a\sqrt{\frac{2}{3}}$ $h=\frac{2a}{\sqrt{3}}$

11. 2

12. 2 sec.
-64 ft/sec
128 ft.

13. a) -12 ft/sec (for chart see below)
b) $-6\ ft/sec^2$

14. a) -24 ft/sec
b) $t=0,4,-1$ sec.

15. min: -9
max: 15

16. $\frac{-2}{27}$ m/min
$-\frac{8}{3}\ m^2/min$

17. $\frac{4}{3\pi}$ in/min

18. -6 ft/sec : length
-10 ft/sec : tip

19. $-\frac{3}{2}$ ft/sec
or $\frac{3}{2}$ ft/sec down the wall

20. 102 mph

13.

t	v(t)	dir.	a(t)	speed ↑↓
$(-\infty,0)$	+	rt	−	↓
$t=0$	0	change	−	0
$(0,3/2)$	−	left	−	↑
$t=3/2$	−	left	0	constant
$(3/2,3)$	−	left	+	↓
$t=3$	0	change	+	0
$(3,\infty)$	+	rt	+	↑

b) What is the rate of change of the surface area of the cube at this moment?

17. In the bottom of an hourglass a conical pile of sand is formed at a rate of 12 in^3 per minute. The radius of the base of the pile is always equal to one-half its altitude. How fast is the altitude rising when it is 6 inches deep?

18. At night, a man 6 feet tall walks at a rate of 4 ft/sec toward a streetlamp which is 10 ft above the ground. What is the rate of change of the tip of his shadow? What is the rate of change of the length of his shadow when he is 8 feet from the base of the light?

19. A ten-foot ladder leaning against a wall is pulled away from the wall at the rate of 2 ft/sec. How fast is the top of the ladder sliding down the wall when it is 8 feet above the ground?

20. A road and railroad track cross at right angles. A car going 60 mph crosses the track 10 minutes before a high-speed train traveling at a rate of 90 mph. How fast is the distance between them changing 10 minutes after the train crosses the intersection?