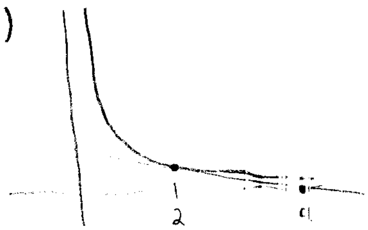
HW 4 solutions

Section 1.3

#60)



The point on the graph when $x=2$ is $(2, \frac{1}{2})$

The slope of the tangent line at that point is

$$f'(2) = -\frac{1}{2^2} = -\frac{1}{4}$$

So the equation of the tangent line is

$$y - \frac{1}{2} = -\frac{1}{4}(x-2)$$

To find a, which is the x-intercept, plug in 0 for y and solve for x:

$$0 - \frac{1}{2} = -\frac{1}{4}(x-2)$$

$$-\frac{1}{2} = -\frac{1}{4}x - \frac{1}{2}$$

$$-1 = -\frac{1}{4}x$$

$$4 = x$$

So, $\boxed{a=4}$

Section 1.6

#54) $y' = 3x^2 - 12x - 34$

To find where slope is 2, solve $y' = 2$:

$$3x^2 - 12x - 34 = 2$$

$$3x^2 - 12x - 36 = 0$$

$$3(x^2 - 4x - 12) = 0$$

$$3(x-6)(x+2) = 0$$

So $x = 6$ or $x = -2$

OR

$$x = \frac{12 \pm \sqrt{144 - 4\cdot 3\cdot(-36)}}{2\cdot 3}$$

$$= \frac{12 \pm \sqrt{576}}{6}$$

$$= \frac{12 \pm 24}{6} = \frac{36}{6} \text{ or } \frac{-12}{6}$$

$$= 6 \text{ or } -2$$

Now, $y(6) = 6^3 - 6\cdot 6^2 - 34\cdot 6 - 9 = -213$

$y(-2) = (-2)^3 - 6\cdot(-2)^2 - 34(-2) - 9 = 27$

So the two points are $(6, -213)$ and $(2, 27)$

Section 1.7

#40) $A \leftrightarrow d$, $B \leftrightarrow b$, $C \leftrightarrow a$, $D \leftrightarrow c$

Section 1.8

#11) a) $s'(6) = 4 \cdot 6 + 4 = 28$ km/hr

b) $s(6) = 2 \cdot 6^2 + 4 \cdot 6 = 96$ km

c) $s'(t) = 4t + 4 = 6$

$4t = 2$

$t = \frac{1}{2}$ So, it's traveling at a rate of 6 km/hr when $t = \frac{1}{2}$ hr

#14) a) $s(t) = t^2 + t = 20$

$t^2 + t - 20 = 0$

$t = \frac{-1 \pm \sqrt{1 - 4 \cdot 1 \cdot (-20)}}{2 \cdot 1} = \frac{-1 \pm \sqrt{81}}{2} = \frac{-1 \pm 9}{2} = \frac{-10}{2}$ or $\frac{8}{2}$

$= -5$ or 4

So the helicopter will be 20 feet high after 4 seconds

(We may disregard $t = -5$ by the context of the question)

b) $s'(t) = 2t + 1$

$s''(t) = 2$

So velocity at time 4 seconds $= s'(4) = 2 \cdot 4 + 1 = 9$ ft/s

acceleration " " " $= s''(4) = 2$ ft/s^2

#15) $A \leftrightarrow b$, $B \leftrightarrow d$, $C \leftrightarrow f$, $D \leftrightarrow e$, $E \leftrightarrow a$, $F \leftrightarrow c$, $G \leftrightarrow g$

#21) $f(4) = 120$ means the temp. is 120° 4 seconds after it was poured

$f'(4) = -5$ means it's cooling at a rate of 5° per minute

$f(4.1) \approx f(4) + f'(4)(4.1 - 4) = 120 + -5(0.1)$

$= 120 - 0.5$

$= 119.5$

32) a) $s(3.5) = 60$ feet

b) $s'(2) = 20$ ft/s

c) $s''(1) = 10$ ft/s^2

d) After 5.5 seconds, since $s(5.5) = 120$

e) At $t = 7$ seconds, since $s'(7) = 20$

f) Greatest velocity $= 30$ ft/sec, achieved at $t = 4.5$ seconds,

At this time, the vehicle has traveled $s(4.5) = 90$ feet.

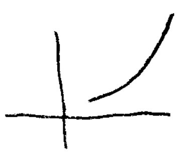
Section 2.1

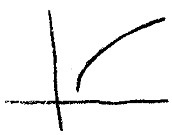
#1) a, e, f

#2) c, d

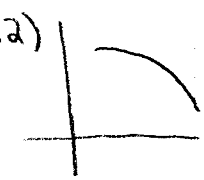
#3) b, c, d

#4) a, e

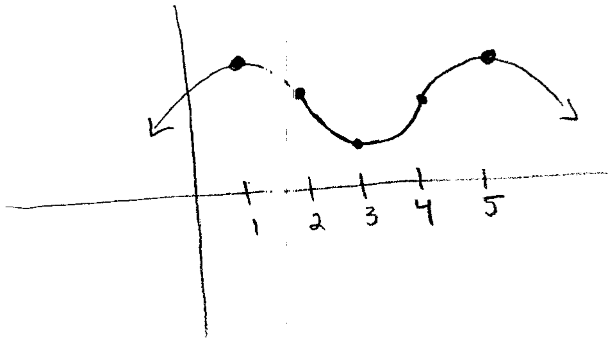
#19) 

#20) 

#21) 

#22) 

#36)



Section 2.2

#1) e

#2) b, c, f

#3) a, b, d, e

#4) f

#5) d

#6) c

Section 2.3

#8) $f(x) = 2x^3 + 3x^2 - 3$

$f'(x) = 6x^2 + 6x = 6x(x+1) = 0$ if $x = 0$ or -1

So critical values are 0 and -1

	$x < -1$	$-1 < x < 0$	$x > 0$
$6x$	$-$	$-$	$+$
$x+1$	$-$	$+$	$+$
f'	$+$	$-$	$+$
f	inc	dec	inc

Since f goes from increasing to decreasing at $x=-1$, there is a local max at $x=1$. Since f goes from decreasing to increasing at $x=0$, there is a local min at $x=0$.

#26) $y = x^3 - 6x^2 + 9x + 3$

$y' = 3x^2 - 12x + 9$

$= 3(x^2 - 4x + 3)$

$= 3(x-3)(x-1) = 0$ if $x = 3$ or $x = 1$.

$y(3) = 3^3 - 6\cdot 3^2 + 9\cdot 3 + 3 = 3$

$y(1) = 1^3 - 6\cdot 1^2 + 9\cdot 1 + 3 = 7$

So critical pts. are $(3,3)$ & $(1,7)$

	$x<1$	$1<x<3$	$x>3$
$3(x-3)$	−	−	+
$(x-1)$	−	−	+
y'	+		+
y	inc	dec	inc

So $(1,7)$ is a max, $(3,3)$ is a min

OR

$y'' = 6x - 12$

$y''(1) = 6\cdot 1 - 12 = -6 < 0$

So $(1,7)$ is a max

$y''(3) = 6\cdot 3 - 12 = 6 > 0$

So $(3,3)$ is a min.

Find inflection pts

$y'' = 6x - 12 = 0$ if $x = 2$.

	$x<2$	$x>2$
y''	−	+

Put it all together:

	$x<1$	$1<x<2$	$2<x<3$	$x>3$
y'	+	−	−	+
y''	−	−	+	+
y				

Graph: