Calculus 3.6 Higher Order Derivatives

(3) Find d^3y/dx^3

$y = (3x+5)^3$

$y' = 3(3x+5)^2 \cdot 3 = 9(3x+5)^2$

$y'' = 18(3x+5)^1 \cdot 3 = 54(3x+5)^1$

$y''' = 54(3x+5)^0 \cdot 3 = 162$

$\boxed{y''' = 162}$

(19) Without doing any calculating, find each derivative

(a) $D_x^4(3x^3+2x-19) = 0.$ (c) $D_x^{11}(x^2-3)^5 = 0.$

(b) $D_x^{12}(100x^{11} - 79x^{10}) = 0$

(22) Suppose that $g(t) = at^2+bt+c$ and $g(1) = 5$

$g'(1) = 3$ and $g''(1) = -4$ Find a, b, and c

$g(t) = at^2+bt+c$

$g(1) = a(1)^2+b(1)+c = a+b+c$

* $5 = a+b+c$

$g'(t) = 2at+b$

$g'(1) = 2a(1)+b = 2a+b$

** $3 = 2a+b$ $a=-2$

$3 = 2(-2)+b$

$3 = -4+b$

$\boxed{7 = b}$

$g''(t) = 2a$

$g''(1) = 2a$

$-4 = 2a$

$\boxed{-2 = a}$

$a+b+c = 5$

$-2+7+c = 5$

$5+c = 5$

$\boxed{c = 0}$

t	$s = t^3 - 6t^2$
-1	$(-1)^3 - 6(-1)^2 = -1 - 6 = -7$
0	0
1	$(1)^3 - 6(1)^2 = 1 - 6 = -5$
4	$(4)^3 - 6(4)^2 = 64 - 6(16) = -32$
5	$(5)^3 - 6(5)^2$ $5^2(5-6) = -25$

(24) $s = t^3 - 6t^2$ s in feet t in seconds

(a) what are the velocity and acceleration at time t

$v(t) = 3t^2 - 12t$

$a(t) = 6t - 12$

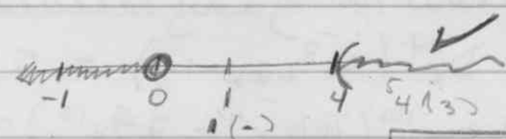
(b) When is the object moving to the Right?

$v(t) > 0$

$3t^2 - 12t > 0$

$t(3t - 12) > 0$

$0, 4$



$(-1)(-15) > 0$

$\boxed{t > 4}$

(c) When is it moving to the left?

$v(t) < 0$

$t(3t - 12) < 0$

$t = 0$ $3t - 12 = 0$

$t = 4$

$\boxed{0 < t < 4}$

t	$t(3t-12)$	yes left
1	neg	yes.
5	pos.	no.

(d) When is its acceleration negative?

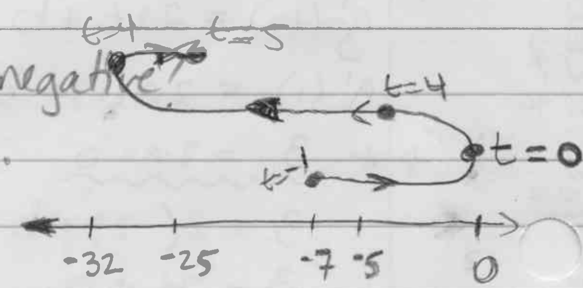
$a(t) < 0$

$6t - 12 < 0$

$6t < 12$

$\boxed{0 \le t < 2}$

(e)



(34) An object thrown directly upward from ground level with an initial velocity of 48 feet per second is $s = 48t - 16t^2$ feet high at the end of t seconds.

(a) What is the maximum height attained?

$$v(t) = 0$$
$$48 - 32t = 0$$
$$48 = 32t$$
$$\frac{48}{32} = t$$
$$\boxed{\text{Seconds } \frac{3}{2} = t}$$

(b) How fast is the object moving, and in which direction, at the end of 1 second?

$$v(t) = 48 - 32t$$
$$v(1) = 48 - 32$$
$$\boxed{v(1) = 16 \text{ ft/second}}$$ upward direction.

c) How long does it take to return to it's original position?

$$s(0) = 48(0) - 16(0)^2 = 0$$
$$s(t) = 48t - 16t^2$$
$$= t(48 - 16t) = 0$$
$$t = 0 \qquad 48 - 16t = 0$$
$$48 = 16t$$
$$\frac{48}{16} = t$$
$$3 \text{ sec} = t$$