

**NEW MEXICO OIL CONSERVATION COMMISSION**  
Santa Fe, New Mexico

**MISCELLANEOUS REPORTS ON WELLS**

Submit this report in triplicate to the Oil Conservation Commission or its proper agent within ten days after the work specified is completed. It should be signed and sworn to before a notary public for reports on beginning drilling operations, results of shooting well, results of test of casing shut-off, result of plugging of well, and other important operations, even though the work was witnessed by an agent of the Commission. Reports on minor operations need not be signed and sworn to before a notary public. See additional instructions in the Rules and Regulations of the Commission.

Indicate nature of report by checking below:

REPORT ON BEGINNING DRILLING OPERATIONS		REPORT ON REPAIRING WELL	
REPORT ON RESULT OF SHOOTING OR CHEMICAL TREATMENT OF WELL		REPORT ON PULLING OR OTHERWISE ALTERING CASING	
REPORT ON RESULT OF TEST OF CASING SHUT-OFF	<b>X</b>	REPORT ON DEEPENING WELL	
REPORT ON RESULT OF PLUGGING OF WELL			

Monument, New Mexico

Place

January 16, 1937

Date

OIL CONSERVATION COMMISSION,  
Santa Fe, New Mexico.

Gentlemen:

Following is a report on the work done and the results obtained under the heading noted above at the \_\_\_\_\_

Amerada Petroleum Corporation Ira French Well No. 2 in the  
Company or Operator Lease  
NE 1/4 NW 1/4 of Sec. 32, T. 19, R. 37, N. M. P. M.,  
Monument Field, Lea County.

The dates of this work were as follows: \_\_\_\_\_

Notice of intention to do the work was ~~[was not]~~ submitted on Form C-102 on January 13, 1937 19\_\_\_\_  
and approval of the proposed plan was ~~[was not]~~ obtained. (Cross out incorrect words.)

**DETAILED ACCOUNT OF WORK DONE AND RESULTS OBTAINED**

8 5/8" 32# 8-Thd. New Seamless casing was set in this well at 2481' and cemented by the Halliburton Method with 600 sacks.

Casing and fittings were tested with 1200# pump pressure and allowed to stand undisturbed for thirty minutes. No drop in pressure resulted so the cement was then drilled out of the casing and the same test of 1200# pump pressure again applied and allowed to stand undisturbed for thirty minutes. No drop in pressure resulted so the drilling was then resumed.

Witnessed by Ira French Rowan Drilling Co. Toolmaster  
Name Company Title

Subscribed and sworn to before me this \_\_\_\_\_

16 day of January, 1937

Lewis D. Wrensch  
Notary Public

My Commission expires Dec. 21, 1940

I hereby swear or affirm that the information given above is true and correct.

Name J. A. Starkey

Position Farm Boss

Representing Amerada Petroleum Corporation  
Company or Operator

Address Monument, New Mexico

Remarks:

J. A. Starkey  
Name  
Title



# Math 101 - Calculus I

## Chapter 1: Limits and Continuity

### Section 1.1: Limits

#### 1.1.1: The $\epsilon$ - $\delta$ Definition

Let  $f$  be a function defined on an open interval  $(a, b)$  and let  $c$  be a point in  $(a, b)$ . We say that  $f$  has a limit  $L$  as  $x$  approaches  $c$  if for every  $\epsilon > 0$  there exists a  $\delta > 0$  such that for all  $x$  in  $(a, b)$  with  $0 < |x - c| < \delta$ , we have  $|f(x) - L| < \epsilon$ .

Symbolically, we write  $\lim_{x \rightarrow c} f(x) = L$ .

Example: Let  $f(x) = 2x + 1$ . We claim that  $\lim_{x \rightarrow 2} f(x) = 5$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x$  with  $0 < |x - 2| < \delta$ , we have  $|f(x) - 5| < \epsilon$ . Note that  $|f(x) - 5| = |2x + 1 - 5| = |2x - 4| = 2|x - 2|$ . So if  $|x - 2| < \delta$ , then  $|f(x) - 5| < 2\delta$ . We want  $2\delta < \epsilon$ , so we choose  $\delta = \epsilon/2$ .

Example: Let  $f(x) = x^2$ . We claim that  $\lim_{x \rightarrow 2} f(x) = 4$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x$  with  $0 < |x - 2| < \delta$ , we have  $|f(x) - 4| < \epsilon$ . Note that  $|f(x) - 4| = |x^2 - 4| = |x - 2||x + 2|$ . So if  $|x - 2| < \delta$ , then  $|f(x) - 4| < \delta|x + 2|$ . We want  $\delta|x + 2| < \epsilon$ . Since  $|x + 2| < \delta + 2$ , we have  $\delta|x + 2| < \delta(\delta + 2)$ . We want  $\delta(\delta + 2) < \epsilon$ . We can choose  $\delta = \min\{1, \epsilon/3\}$ .

Example: Let  $f(x) = \sin(x)$ . We claim that  $\lim_{x \rightarrow 0} f(x) = 0$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x$  with  $0 < |x| < \delta$ , we have  $|\sin(x)| < \epsilon$ . Since  $|\sin(x)| \leq |x|$ , we can choose  $\delta = \epsilon$ .

Example: Let  $f(x) = \cos(x)$ . We claim that  $\lim_{x \rightarrow 0} f(x) = 1$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x$  with  $0 < |x| < \delta$ , we have  $|\cos(x) - 1| < \epsilon$ . Since  $|\cos(x) - 1| = 2\sin^2(x/2) \leq 2(x/2)^2 = x^2/2$ , we can choose  $\delta = \sqrt{2\epsilon}$ .

Example: Let  $f(x) = \tan(x)$ . We claim that  $\lim_{x \rightarrow 0} f(x) = 0$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x$  with  $0 < |x| < \delta$ , we have  $|\tan(x)| < \epsilon$ . Since  $|\tan(x)| = |\sin(x)/\cos(x)| \leq |\sin(x)|/|\cos(x)| \leq |x|/|\cos(x)|$ , we can choose  $\delta = \epsilon \cos(\delta)$ .

Example: Let  $f(x) = \ln(x)$ . We claim that  $\lim_{x \rightarrow 1} f(x) = 0$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x$  with  $0 < |x - 1| < \delta$ , we have  $|\ln(x)| < \epsilon$ . Since  $|\ln(x)| = |\ln(x) - \ln(1)| = |\ln(x/1)| = |\ln(x)|$ , we can choose  $\delta = e^\epsilon - 1$ .

Example: Let  $f(x) = e^x$ . We claim that  $\lim_{x \rightarrow 0} f(x) = 1$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x$  with  $0 < |x| < \delta$ , we have  $|e^x - 1| < \epsilon$ . Since  $|e^x - 1| = e^x - 1$  for  $x > 0$  and  $1 - e^{-x}$  for  $x < 0$ , we can choose  $\delta = \ln(1 + \epsilon)$ .

Example: Let  $f(x) = e^{-x}$ . We claim that  $\lim_{x \rightarrow 0} f(x) = 1$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x$  with  $0 < |x| < \delta$ , we have  $|e^{-x} - 1| < \epsilon$ . Since  $|e^{-x} - 1| = 1 - e^{-x}$  for  $x > 0$  and  $e^x - 1$  for  $x < 0$ , we can choose  $\delta = \ln(1 + \epsilon)$ .

Example: Let  $f(x) = \ln(x)$ . We claim that  $\lim_{x \rightarrow \infty} f(x) = \infty$ . To verify this, let  $M > 0$  be given. We need to find a  $N > 0$  such that for all  $x > N$ , we have  $\ln(x) > M$ . Since  $\ln(x) > M$  if and only if  $x > e^M$ , we can choose  $N = e^M$ .

Example: Let  $f(x) = e^x$ . We claim that  $\lim_{x \rightarrow \infty} f(x) = \infty$ . To verify this, let  $M > 0$  be given. We need to find a  $N > 0$  such that for all  $x > N$ , we have  $e^x > M$ . Since  $e^x > M$  if and only if  $x > \ln(M)$ , we can choose  $N = \ln(M)$ .

Example: Let  $f(x) = e^{-x}$ . We claim that  $\lim_{x \rightarrow \infty} f(x) = 0$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $N > 0$  such that for all  $x > N$ , we have  $e^{-x} < \epsilon$ . Since  $e^{-x} < \epsilon$  if and only if  $x > -\ln(\epsilon)$ , we can choose  $N = -\ln(\epsilon)$ .

Example: Let  $f(x) = \ln(x)$ . We claim that  $\lim_{x \rightarrow 0^+} f(x) = -\infty$ . To verify this, let  $M < 0$  be given. We need to find a  $\delta > 0$  such that for all  $x < \delta$ , we have  $\ln(x) < M$ . Since  $\ln(x) < M$  if and only if  $x < e^M$ , we can choose  $\delta = e^M$ .

Example: Let  $f(x) = e^x$ . We claim that  $\lim_{x \rightarrow 0^+} f(x) = 1$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x < \delta$ , we have  $|e^x - 1| < \epsilon$ . Since  $|e^x - 1| = e^x - 1$  for  $x > 0$  and  $1 - e^{-x}$  for  $x < 0$ , we can choose  $\delta = \ln(1 + \epsilon)$ .

Example: Let  $f(x) = e^{-x}$ . We claim that  $\lim_{x \rightarrow 0^+} f(x) = 1$ . To verify this, let  $\epsilon > 0$  be given. We need to find a  $\delta > 0$  such that for all  $x < \delta$ , we have  $|e^{-x} - 1| < \epsilon$ . Since  $|e^{-x} - 1| = 1 - e^{-x}$  for  $x > 0$  and  $e^x - 1$  for  $x < 0$ , we can choose  $\delta = \ln(1 + \epsilon)$ .

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