

## Practice test 2

### 1. Word problems. 3.2.1 - 3.2.54

### 2. Limits.

- Find the limit of  $f(x) = x^2$  at the point  $x = -1$ .
- Find the limit of  $f(w) = 2w^2 - 5w + 3$  at the point  $w = 5$ .
- Find the limit of  $f(t) = (8 - 2t)/(3t - 9)$  at the point  $t = 4$ .
- Find the limit of  $f(x) = (x - 1)/(x + 1)$  at the point  $x = -1$ .
- Find the limit of  $f(u) = (u^2 + 2u)/(u^2 - 2u)$  at the point  $u = 2$ .
- Find the limit of  $f(y) = (y^2 + y + 1)/(y + 1)$  at the point  $y = -1$ .
- Find the limit of  $f(x) = (5 + 2x)/(x^3)$  at the point  $x = 0$ .
- Find the limit of  $f(t) = (t^2 - t)/(t^3 - t)$  at the point  $t = 1$ .
- Find the limit of  $f(x) = (11 - 7x)/(8 + 10x)$  at the point  $x = -.8$ .
- Find the limit of  $f(t) = (t^4 - 1)/(t^3 - 1)$  at the point  $t = 1$ .
- Find the limit of  $f(x) = (4 + 2x - x^2 + x^3)/(x^2 + 2x + 1)$  at the point  $x = -1$ .
- Find the limit of  $f(y) = (y^4 - 4y^2)/(y^4 + 8y)$  at the point  $y = -2$ .

### 3. Summation notation.

- Evaluate this sum:  $\sum_{n=1}^5 n =$
- Evaluate this sum:  $\sum_{n=1}^8 2n =$
- Evaluate this sum:  $\sum_{m=1}^6 (3m + 2) =$
- Evaluate this sum:  $\sum_{m=1}^{10} (2m - 1) =$
- Evaluate this sum:  $\sum_{k=1}^4 1/k =$
- Evaluate this sum:  $\sum_{k=1}^5 3/(2k) =$
- Evaluate this sum:  $\sum_{j=1}^7 (j - 1)^2 =$
- Evaluate this sum:  $\sum_{n=0}^5 n(n + 1) =$
- Evaluate this sum:  $\sum_{i=1}^{10} i(i + 1) =$
- Evaluate this sum:  $\sum_{i=2}^{70} (i + 3) =$
- Evaluate this sum:  $\sum_{i=0}^3 2^{i+1} =$
- Evaluate this sum:  $\sum_{j=0}^4 (-1)^j =$
- Evaluate this sum:  $\sum_{n=0}^4 n^3 =$
- Evaluate this sum:  $\sum_{n=1}^{10} [1/n - 1/(n + 1)] =$

### 4. Straight lines.

- Find the equation of the line passing through the points (3,0) and (0,3).
- Find the equation of the line passing through the points (3,6) and (4,8).
- Find the equation of the line passing through the points (-1,0) and (2,3).
- Find the equation of the line passing through the points (6,4) and (4,5).
- Find the equation of the line passing through the points (-3,-5) and (5,-2).
- Find the equation of the line passing through the points (45,23) and (-18,4).
- Find the equation of the line passing through the points (9,16) and (-34,79).
- Find the equation of the line passing through the points (1/2, 3/8) and (1/3, -2/3).
- Find the equation of the line passing through the points (2, 1/2) and (-1/4, 2).
- Find the equation of the line passing through the points (2, 1/2) and (2, 2).

## 5. Simplifying logarithms.

- Simplify  $\ln(3000)$ .
- Simplify  $\ln(240)$ .
- Simplify  $\ln(3025)$ .
- Simplify  $\ln(1234)$ .
- Simplify  $\ln((12345)^2)$ .
- Simplify  $\ln(x^3 - x^2)$ .
- Simplify  $\ln(y^2 - 1)$ .
- Simplify  $\ln(z^2/(z + 2))$ .
- Simplify  $\ln((x^2 + 1)/(x^2 - 1))$ .
- Simplify  $\ln((u^2v^3/w^5)^2)$ .

## 6. Exponential equations.

- Solve the following equation in  $x$ :  $e^{2x} = e^8$ .
- Solve the following equation in  $x$ :  $e^{3x-1} = e^{-3}$ .
- Solve the following equation in  $x$ :  $e^{x^2-1} = e$ .
- Solve the following equation in  $x$ :  $e^{x^2+2} = e$ .
- Solve the following equation in  $x$ :  $e^{x+1} = 2$ .
- Solve the following equation in  $x$ :  $e^{x^2+1} = 1$ .
- Solve the following equation in  $x$ :  $e^{-x} = e^{2x+2}$ .
- Solve the following equation in  $x$ :  $(e^{x-3})^2 = 2$ .
- Solve the following equation in  $x$ :  $2e^x = e^{4x-2}$ .
- Solve the following equation in  $x$ :  $(e^{2x})^{1/2} = 34$ .

## 7. Exponential growth.

### • Population growth

- We are studying the size of a bacteria culture. The bacteria culture was measured after 5 hours as having size  $P(5) = 90,000$ ; after 8 hours it has grown to  $P(8) = 100,000$ . Assume the growth is exponential, i.e.,  $P(t)$  behaves like  $P(t) = Ce^{kt}$ . Determine  $C$  and  $k$ .
- We are studying the size of a bacteria culture. The bacteria culture was measured after 1 hour as having size  $P(1) = 1,000,000$ ; after 3 hours it has grown to  $P(3) = 5,000,000$ . Assume the growth is exponential, i.e.,  $P(t)$  behaves like  $P(t) = Ce^{kt}$ . Determine  $C$  and  $k$ .
- We are studying the size of a fish family. The fish family was measured after 100 days as having size  $P(100) = 5000$ ; after 200 days it has grown to  $P(200) = 5500$ . Assume the growth is exponential, i.e.,  $P(t)$  behaves like  $P(t) = Ce^{kt}$ . Determine  $C$  and  $k$ .
- We are studying the size of a bacteria culture. The bacteria culture was measured initially ( $t = 0$ ) as having size  $P(0) = 100,000$ ; after 4 hours it has grown to  $P(4) = 600,000$ . Assume the growth is exponential, i.e.,  $P(t)$  behaves like  $P(t) = Ce^{kt}$ . Determine  $C$  and  $k$ .

### • Half-life.

- How long will it take 600 grams of Plutonium 239 (half life 24,400 years) to decay to 18.75 grams?
- How many grams of iodine 131 (half life 8.07 days) would be left after 48.42 days if you start with 25 grams?
- Approximately how many years must a sample of Americium 241 (half life 458 years) be stored before it decays to a safe level? (i.e. 3

### • Doubling time.

- A country has a doubling time for its people of 20 years. If it ends up with 80 million people after 60 years, how many people did it have to start with?

- The area covered by water lilies in a pond you own doubles in size every day. If allowed to grow the plants would cover the entire pond surface in 30 days. You had decided to do nothing until the pond is  $\frac{1}{2}$  covered. On what day will the pond be  $\frac{1}{2}$  covered? How long do you have before you must act or have your pond covered with the plants?
- One bacteria, which divides in half to double its population once per minute, was placed in a test tube with an appropriate bacterial environment. After 59 minutes the test tube was  $\frac{1}{2}$  full. When would it be expected to fill the tube? Research and development makes a great discovery that allows the population to expand into 3 more tubes. How many more minutes can the bacteria double?
- Human newborns usually weigh about 7.5 lb.. at birth. They double that in 6 months. If its weight continued to double every six months, how much would an average 5 year old weigh?
- E. coli, a type of bacteria, divides once every 15 minutes. Calculate how many will exist after 24 hours if their biotic potential is infinite and its environmental resistance is zero.