Answer the first seven questions and one of the others. Each answer should be reduced to its simplest form. Papers entitled to less than 75 credits will not be accepted.

1 Expand by the binomial theorem, giving all the work:

$$\left(2x^3 + \frac{3}{a}\right)^6$$

2 Find the prime factors of *each* of the following:

$$3x^3 - 2x^2 + x - 2$$
$$16a^4 - b^8$$
$$x^4 + x^2y^2 + y^4$$
$$12a^2 - 10a - 12$$

3 Write the discriminant and state the nature of the roots of *each* of the following equations:

$$\frac{x}{3} - 4 = \frac{2}{x}$$
$$.2x^2 - .45x + .375 = 0$$
$$2x = 2x^2 + \tfrac{1}{2}$$

4 Form the equation whose roots are $-2 + \sqrt{6}$ and $-2 - \sqrt{6}$

5 In the equation $x^2 + kx - 9 = 0$, find the value of k if one root is 3.

6 Solve
$$3x^2 - 5y^2 = 7$$
$$3xy - 4y^2 = 2$$

7 $W = .3\frac{\pi}{4} l(D^2 - d^2)$

If $W = 1.245$, $l = 12$, $D = 1.2$, $\pi = 3.1416$, find the value of d.

8 A man drives a car at the rate of 16 miles an hour. After driving 5 hours he stops 3 hours and then continues at his former rate. Four hours after the man starts, a train starts on a parallel road at the rate of 32 miles an hour. How far must the train travel to pass the man? Construct a graph and from it determine your answer.

9 A picture is 10″ long and 8″ wide; find the width of a mat about this picture which is equal in area to the area of the picture.