

Answers must be exact or must have 4 (or more) significant digits, correctly rounded, unless otherwise noted.

Problems 19-20. Time limit 10 minutes.

19. Find a two-digit number whose value is twice the product of its digits.

20. Al, Bob, Carl, and Dave were accused of a crime. They each made a statement. Exactly three of the statements are true. Who is guilty? The statements are as follows. Al: If I'm guilty, then Carl lied.

Bob: Dave lied when he said I did it. Carl: If Al isn't guilty, then Bob is guilty. Dave: Bob did it.

Problems 21-22. 10 minutes.

21. Factor completely over the integers:  $x^2(x-1) - 3x^2 - 7x + 10$

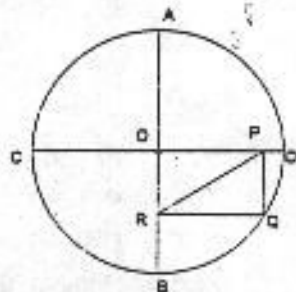
22. Points A(-6,0) and B(0,6) are marked. All points P on the plane with  $AP + PB = 20$  are graphed to form an ellipse. Find the length of the minor axis of the ellipse.

Problems 23-24. 11 minutes.

23. A standard, fair six-sided die is rolled repeatedly until a "5" occurs. Find the probability that this will take four or fewer rolls.

24. [a classic] In the circle with center O,  $\overline{AB}$  and  $\overline{CD}$  are perpendicular diameters.  $\overline{PQ} \parallel \overline{AB}$  and  $\overline{QR} \parallel \overline{CD}$ .

$PR = 10$  and  $PD = 2$ .



Find the diameter of the circle.