This Review Sheet is only for new material: Sections 3.2-3.4, 4.3-4.4, 6.1-6.2, 6.5
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1. Given $f(x) = -x^4 + x^3 + 20x^2$, (a) Describe the right- and left- hand behavior, (b) find all real zeros and state the multiplicity of each, and (c) determine the maximum possible number of turning points. [Show work.]
(a). Falls to the left and right **(b).** 0 has multiplicity 2, 5 has multiplicity 1, -4 has multiplicity 1 **(c).** 3

2. Find a polynomial of degree 4 that has the zeros $x = -1, 2, 4$. [There are many correct answers.]
One possibility: $f(x) = (x+1)^2(x-2)(x+4)$

3. Use long division to divide.

(a). $(4x^3 - 3x + 2) \div (2x - 1)$ $= 2x^2 + x - 1 + \dfrac{1}{2x-1}$ **(b).** $(x^4 + 9x^3 - 5x^2 - 36x + 4) \div (x^2 - 4)$ $= x^2 + 9x - 1,\ x \neq \pm 2.$

4. Use synthetic division to divide $(5x^3 + 6x + 8) \div (x + 2)$. $5x^2 - 10x + 26 - \dfrac{44}{x+2}$

5. Use the Remainder Theorem and synthetic division to find $f(3)$ for $f(x) = 2x^3 - 3x^2 - x + 4$ 28

6. Use synthetic division to show that $x = \frac{2}{3}$ is a solution of $48x^3 - 80x^2 + 41x - 6 = 0$. Use the result to factor the polynomial completely and find the remaining real solutions. 0 remainder; $(3x-2)(4x-3)(4x-1)$; Solutions: $\frac{2}{3}, \frac{3}{4}\frac{1}{4}$

7. Verify that $(x+3)$ and $(x-2)$ are factors of $f(x) = 3x^3 + 2x^2 - 19x + 6$. Use the result to factor the polynomial completely and find all real zeros. Syn. Div. twice with remainder 0 $\Rightarrow f(x) = (x+3)(x-2)(3x-1)$; zeros: $-3, 2, \frac{1}{3}$

8. Given $f(x) = 3x^3 + 25x^2 - 19x - 9$

(a). List all <u>possible</u> rational zeros of f. $\dfrac{\pm 1, \pm 3, \pm 9}{\pm 1, \pm 3} = \pm 1, \pm \dfrac{1}{3}, \pm 3, \pm 9$

(b). Determine all the real zeros of f. $x = 1, -9, -1/3$

9. Find the directrix and focus of the parabola $x^2 + y = 0$. Then sketch the parabola. focus: $\left(0, -\dfrac{1}{4}\right)$

10. Find the standard equation of an ellipse centered at the origin with foci at $(\pm 2, 0)$ and major axis length of 10. $\dfrac{x^2}{25} + \dfrac{y^2}{21} = 1$

11. Find the vertices, foci, and asymptotes* of the hyperbola $\dfrac{y^2}{64} - x^2 = 1$. Then sketch the hyperbola.
*[Added to Formula Sheet.] vertices: $(0, \pm 8)$; foci: $(0, \pm\sqrt{65})$, asymptotes: $y = \pm 8x$; The transverse axis is vertical.

12. Find the standard form of the equation of a parabola that has the vertex at $(3, -1)$, passes through the point $(6, 5)$, and has a horizontal axis. $(y+1)^2 = 4(3)(x-3)$

13. Find the center, vertices, and foci of the ellipse $4(x+2)^2 + (y+4)^2 = 1$. Then sketch the ellipse.
center: $(-2, -4)$; vertices: $(-2, -5)$ and $(-2, -3)$; foci: $(-2, -4 - \sqrt{3}/2)$ and $(-2, -4 + \sqrt{3}/2)$; major axis vertical.

14. Find the standard form of the equation of the hyperbola with vertices: $(1, 2), (5, 2)$ and foci: $(0, 2), (6, 2)$.
$\dfrac{(x-3)^2}{4} - \dfrac{(y-2)^2}{5} = 1$

15. Given the following equations for a conic, write the equation in standard form and then identify whether the conic is a parabola, circle, ellipse, or hyperbola.

(a). $-9x^2 + y^2 - 54x - 4y - 113 = 0$ $\dfrac{(y-2)^2}{36} - \dfrac{(x+3)^2}{4} = 1$; hyperbola

(b). $y^2 - 8y - 4x = 0$ $(y-4)^2 = 4(x+4)$; parabola

16. Section 6.1 #34, 24 34. $(1, -1)$ 24. No Solution

17. Section 6.2 #14, 24, 26 14. $(6, 2)$ 24. Infinitely many solutions (all points $y = -\frac{7}{8}x + \frac{3}{4}$ are solutions) 26. $\left(\frac{90}{31}, -\frac{67}{31}\right)$

18. Section 6.1 #30 $(0, 0)$ and $(12, 6)$

19. Section 6.5 #25 [Sketch by hand.]

20. Section 6.5 #45

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