1. Write the following complex numbers in standard form.

   (a) $(-4-8i)(3+i)$ Section 2.1, exercise 12:

   $$-4\cdot 3+(-8i)\cdot 3+(-4)\cdot i+(-8i)i=-12-24i-4i+-8i^2$$
   $$=-12-28i+8=-4-28i$$

   (b) $\dfrac{-6i}{3+2i}$ Section 2.1, exercise 26:

   $$\frac{-6i}{3+2i}\cdot\frac{3-2i}{3-2i}=\frac{-18i+12i^2}{9+4}=\frac{-12-18i}{13}=\frac{-12}{13}-\frac{18}{13}i$$

   (c) $\dfrac{3-4i}{4+3i}$ Section 2.1, exercise 28:

   $$\frac{3-4i}{4+3i}\cdot\frac{4-3i}{4-3i}=\frac{12-9i-16i+12i^2}{16+9}=\frac{-\cancel{25}i}{\cancel{25}}=i$$

2. Find all solutions to the following equations.

   (a) $x^2-6x+10=0$ Section 2.1, exercise 45:
   Apply the quadratic formula:

   $$x=\frac{-(-6)\pm\sqrt{(-6)^2-4(1)(10)}}{2(1)}$$

   This reduces to:

   $$x=3\pm i$$

   (b) $3x^2=8x-7$ Section 2.1, exercise 49:
   Rewrite the function:

   $$3x^2-8x+7=0$$

   Apply the quadratic formula:

   $$x=\frac{-(-8)\pm\sqrt{(-8)^2-4(3)(7)}}{2(3)}=\frac{4\pm i\sqrt{5}}{3}$$

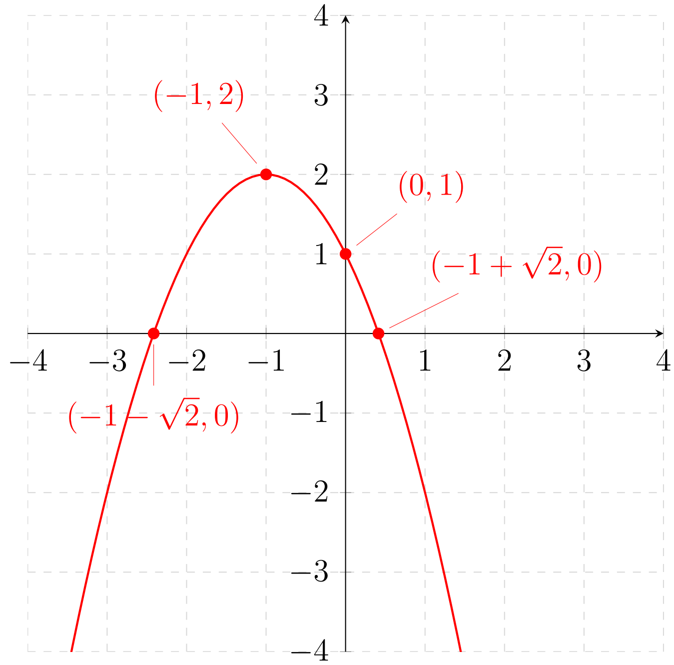
   (c) $3x^2=4x-6$ Section 2.1, exercise 50:
   Rewrite the function:

   $$3x^2-4x+6=0$$

   Apply the quadratic formula:

   $$x=\frac{-(-4)\pm\sqrt{(-4)^2-4(3)(6)}}{2(3)}=\frac{2\pm i\sqrt{14}}{3}$$

3. Graph the following function: $f(x) = -x^2 - 2x + 1$. Mark on the graph (at the very least) the vertex, the x-intercepts (if any), and the y-intercept. p.305, example:



4. Find all zeroes of the following polynomials:

   (a) $f(x) = x^3 + 3x^2 - x - 3$ p.322, example:
   Factor by grouping:

   $$f(x) = x^3+3x^2-x-3 = x^2(x+3)-(x+3) = (x^2-1)(x+3) = (x-1)(x+1)(x+3)$$

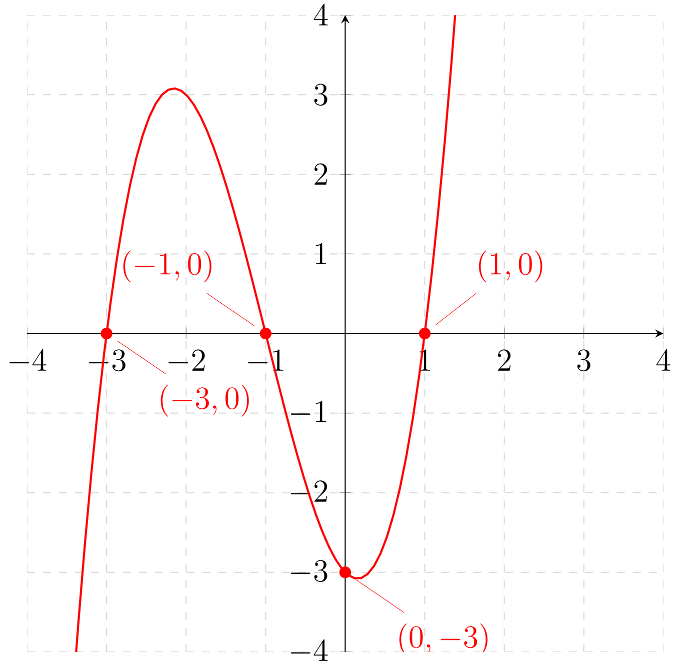
   Zeroes: $x = -3, -1, 1$

   (b) $f(x) = x^3 + x^2 - 5x - 2$ p.350, example:
   Rational Zeroes Theorem: all possible rational zeroes: $x = \frac{\pm 1}{\pm 1}, \frac{\pm 2}{\pm 1} = 1, -1, 2, -2.$
   Test $x = 2$: $f(2) = 2^3 + 2^2 - 5(2) - 2 = 0$; so $(x-2)$ is a factor of $f(x)$. Thus,

$$\begin{array}{r|l} & x^2 + 3x + 1 \\ x-2 & x^3 + x^2 - 5x - 2 \\ & -x^3 + 2x^2 \\ & 3x^2 - 5x \\ & -3x^2 + 6x \\ & x - 2 \\ & -x + 2 \\ & 0 \end{array}$$

   So $x^3 + x^2 - 5x - 2 = (x-2)(x^2+3x+1)$. The quadratic term has zeroes $x = \frac{-3 \pm \sqrt{(3)^2 - 4(1)(1)}}{2(1)} = \frac{-3 \pm \sqrt{5}}{2}$; thus all possible zeroes are $x = 2, \frac{-3 \pm \sqrt{5}}{2}$

5. Graph the polynomial $f(x) = x^3 + 3x^2 - x - 3$.
It is already known from 4(a) where the zeroes are. The end behavior is given by the leading coefficient: rising to the right, falling to the left. Hence:



6. Find the n-th degree polynomial satisfying the given conditions:

(a) $n = 4$, $-2, -\frac{1}{2}, i$ are zeroes; $f(1) = 18$ p.357, exercise 30:
i is a zero means $-i$ is a zero.
So $f(x) = a(x - (-2))(x - (-\frac{1}{2}))(x - i)(x - (-i))$.
Multiplying terms with imaginary elements we have

$$f(x) = a(x + 2)(x + \frac{1}{2})(x^2 + 1)$$

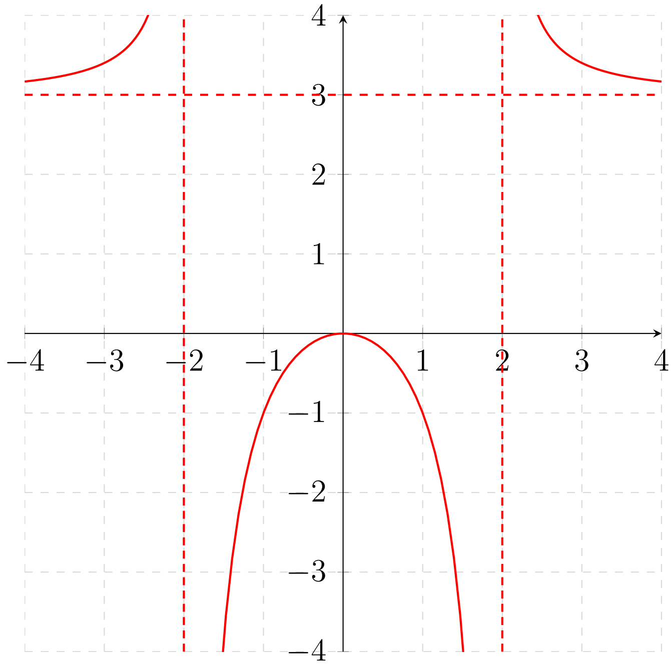
We are told $18 = f(1) = a(1 + 2)(1 + \frac{1}{2})(1^2 + 1) = a(3)(\frac{3}{\not{2}})(\not{2})$; hence $a = 2$ and so $f(x) = 2(x + 2)(x + \frac{1}{2})(x^2 + 1)$; alternatively, $f(x) = (x + 2)(2x + 1)(x^2 + 1)$.

(b) $n = 4$, $-2, 5$, and $3 + 2i$ are zeroes; $f(1) = -96$ p.357, exercise 31
$3 + 2i$ is a zero means $3 - 2i$ is a zero.
So $f(x) = a(x - (-2))(x - 5)(x - (3 + 2i))(x - (3 - 2i))$.
Multiplying terms with imaginary elements we have

$$f(x) = a(x + 2)(x - 5)(x^2 - 6x + 13)$$

We are told $-96 = f(1) = a(1+2)(1-5)(1^2 - 6(1) + 13) = a(3)(-4)(8) = a(-96)$; hence $a = 1$ and so $f(x) = (x + 2)(x - 5)(x^2 - 6x + 13)$

7. Graph $f(x) = \dfrac{3x^2}{x^2-4}$. p.370, example 6:



8. Find the slant asymptote of $f(x) = \dfrac{x^2-4x-5}{x-3}$. p.373, example 8:

$$
\begin{array}{r|l}
 & x - 1 \\
x - 3 & x^2 - 4x - 5 \\
 & -x^2 + 3x \\
\hline
 & -x - 5 \\
 & x - 3 \\
\hline
 & -8
\end{array}
$$

The slant asymptote is given by $y = x - 1$.

9. Solve the inequality $x^3 + x^2 \le 4x + 4$. p.385, example 3:
Rewrite so that 0 is on one side: $x^3 + x^2 - 4x - 4 \le 0$.
Factor by grouping: $x^2(x+1) - 4(x+1) = (x+1)(x^2-4) = (x+1)(x-2)(x+2) \le 0$
Test by positives and negatives: from $-\infty$ to -2, the function is negative. From -2 to -1 the function is positive. From -1 to 2 the function is negative, and from 2 to ∞ the function is positive. Hence our solution set is $(-\infty, -2] \bigcup [-1, 2]$

10. Solve the inequality $\dfrac{x-2}{x+2} \ge 2$. p.391, exercise 59 (modified):
Rewrite: $\dfrac{x-2}{x+2} - 2 \ge 0$; $\dfrac{x-2-2(x+2)}{x+2} = \dfrac{-x-6}{x+2} \ge 0$. Test by positives and negatives: from $-\infty$ to -6 the function is negative. From -6 to -2 the function is positive. From -2 to ∞ the function is negative. However, note that -2 is not a valid solution because of division by zero; hence, our answer is $[-6, -2)$.