1. Use polynomial long division to simplify the rational expression below. There should be a zero remainder.

$$\frac{6x^2 + 11x - 10}{3x - 2}$$

$$
\begin{array}{r}
2x+5 \\
3x-2{\overline{\smash{\big)}\,6x^2+11x-10}} \\
-(6x^2-4x) \downarrow \\
\hline
15x-10 \\
-(15x-10) \\
\hline
0
\end{array}
$$

$$\boxed{2x+5}$$

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2. Write the following in $q(x) + \dfrac{r}{x-a}$ form: $\dfrac{x^3 + 7x^2 + 17x + 41}{x+5}$

$$
\begin{array}{r}
x^2+2x+7 \\
x+5{\overline{\smash{\big)}\,x^3+7x^2+17x+41}} \\
-(x^3+5x^2) \downarrow \\
\hline
2x^2+17x \\
-(2x^2+10x) \downarrow \\
\hline
7x+41 \\
-(7x+35) \\
\hline
6
\end{array}
$$

$$\boxed{x^2+2x+7+\frac{6}{x+5}}$$

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3. Factor completely: $(x+2)^2 - 3(x+2) - 10$ TRAM

↳ 3 terms

Let $y = x+2$

$$y^2 - 3y - 10$$

$$(y-5)(y+2)$$

$$(x+2-5)(x+2+2)$$

$$\boxed{(x-3)(x+4)}$$

4. Express in simplest form: $\dfrac{45a^4b^3 - 90a^3b}{15a^2b}$

$$= \dfrac{\overset{3}{\cancel{45}}a^{\overset{3}{\cancel{4}}}b^{\overset{1}{\cancel{3}}}(ab^2 - 2)}{\cancel{15a^2b}}$$

$$= \boxed{3a(ab^2 - 2)} \quad or \quad \boxed{3a^2b^2 - 6a}$$

5. Factor completely: $81x^3y^3 + 192y^6$

$$3y^3(27x^3 + 64y^3)$$

$$3y^3((3x)^3 + (4y)^3)$$

$a = 3x$
$b = 4y$

$$3y^3(3x + 4y)((3x)^2 - (3x)(4y) + (4y)^2)$$

$$\boxed{3y^3(3x + 4y)(9x^2 - 12xy + 16y^2)}$$