E1

(a) Square y, multiply by 3, add x, multiply by 5.

(b) Divide r by R, add 1, divide E by the result (or, after adding 1, divide by E and find the reciprocal).

(Reread Subsection 2.1 if you had difficulty with this question.)

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E2

(a) $(x + 5)(x + 7) = x^2 + 7x + 5x + 35 = x^2 + 12x + 35$

(b) $x(x + 2)(x^2 - 1) - x^2(2x - 1)$

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

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

(Reread Subsection 2.2 if you had difficulty with this question.)

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E3

$$\frac{2p}{q}+\frac{7pr}{3}=\frac{6p}{3q}+\frac{7pqr}{3q}=\frac{p}{3q}(6+7qr)$$

(Reread Subsections 2.2 and 2.3 if you had difficulty with this question.)

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E4

$v = \sqrt{E / \rho}$. If both sides are squared $v^2 = E/\rho$. If this is then rearranged, $\rho = E/v^2$.

(Reread Subsections 2.4 and 3.2 if you had difficulty with this question.)

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E5

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = \frac{u+v}{uv}$$

So, $$f = \frac{uv}{u+v}$$

(Reread Subsections 2.3 and 3.2 if you had difficulty with this question.)

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E6

$$E_1 = \frac{1}{2}mv_1^2, \quad E_2 = \frac{1}{2}mv_2^2$$

(a) $E_2/E_1 = (mv_2^2/2)/(mv_1^2/2)$. If a factor of $m/2$ is cancelled, $E_2/E_1 = v_2^2/v_1^2$, which can be further simplified to

$E_2/E_1 = (v_2/v_1)^2$.

(b) $E_2 - E_1 = (mv_2^2/2) - (mv_1^2/2)$. If a common factor of $m/2$ is taken out and brackets are added:

$$E_2 - E_1 = \frac{m}{2}\left(v_2^2 - v_1^2\right).$$

(This equation could also be written $E_2 - E_1 = m(v_2 - v_1)(v_2 + v_1)/2$, but this involves more terms.)

(c) $(E_2 - E_1)/E_1 = (E_2/E_1) - (E_1/E_1) = (E_2/E_1) - 1$.
If the answer to (a) is used, $(E_2 - E_1)/E_1 = (v_2/v_1)^2 - 1$.

(Reread Subsections 2.2 and 3.2 if you had difficulty with this question.)

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E7

(a) $\left(l\sqrt{l}\right)\Big/l^2 = l^{3/2}/l^2 = l^{3/2}\,l^{-2} = l^{-1/2}$

(b) $z\left[\left(\sqrt[5]{z^{-1}}\,x^{0.5}y^{0.1}\right)\Big/\left(x^{-1/2}y^{1/5}\right)^2\right]^{1/3}$

$= z\left[\left(z^{-1/5}x^{1/2}y^{1/10}\right)\Big/\left(x^{-1}y^{2/5}\right)\right]^{1/3}$

$= z\left(z^{-1/5}x^{1/2}y^{1/10}xy^{-2/5}\right)^{1/3} = z\left(z^{-1/5}x^{3/2}y^{-3/10}\right)^{1/3}$

$= z^{14/15}x^{1/2}y^{-1/10}$

(Reread Subsection 3.4 if you had difficulty with this question.)

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E8

(a) $F_{\text{el}} \propto q_1$ provided q_2 and r are fixed.

(b) $F_{\text{el}} \propto 1/r^2$ provided q_1 and q_2 are fixed.

(Reread Subsection 3.3 if you had difficulty with this question.)

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E9

$T = k\sqrt{l/g}$ where k is a constant.

(Reread Subsection 3.3 if you had difficulty with this question.)

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E10

(a) x is greater than 3, but less than or equal to 20.

(b) If $a^2x^2 - a^2x^2h \geq 2y$ then $x^2a^2(1-h) \geq 2y$

So $x^2 \geq \dfrac{2y}{a^2(1-h)}$ if $a^2(1-h) > 0$

and $x^2 \leq \dfrac{2y}{a^2(1-h)}$ if $a^2(1-h) < 0$

However, a^2 must be positive, so the condition $a^2(1-h) < 0$ will be satisfied if $h > 1$.

(Reread Subsection 3.4 if you had difficulty with this question.)

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