> restart;with(Riemann):with(TensorPack): with(Canon):CDF(0): CDS(index):

Chapter XX Tensor analysis using indices - Senovilla et al. - Shearfree for acceleration parallel to vorticity if $\sigma_{a\,b}$=0 =>ω⊝=0

Author: Peter Huf

eq74a - omega[a,b]*cod(-a) contraction of SSSeq72

> **read** "EFE" : **read** "SFE" :**read** "fids" :**read** "Seneqs80" :

from SSSeq72c

> $temp := ((-12 * PU * `p''` + 24 * `p'`^2 + 4 * `p'`) * Psi^4 + (36 * `p'`^3 + 24 * `p'`^2) * Psi^2) * omega * omega[-A] * omega[a, b] = 0 : T(\%);$

$$\left(\left(-12\,PU p'' + 24\,p^2 + 4\,p' \right) \Psi^4 + \left(36\,p^3 + 24\,p^2 \right) \Psi^2 \right) \omega\,\omega_{;a}\,\omega^{a\ b} = 0 \qquad (1.1)$$

>

so either

> $temp1 := op(1, op(1, temp)) = 0 : T(\%);$

$$\left(-12\,PU p'' + 24\,p^2 + 4\,p' \right) \Psi^4 + \left(36\,p^3 + 24\,p^2 \right) \Psi^2 = 0 \qquad (1.2)$$

OR

> $temp2 := op(2, op(1, temp)) \cdot op(3, op(1, temp)) op(4, op(1, temp)) = 0 : T(\%);$

$$\omega\,\omega_{;a}\,\omega^{a\ b} = 0 \qquad (1.3)$$

which is SSSeq74b

In this case we look at temp2

>

Now from SSSeq72a and SSSeq72b

> $temp3 := -12 * `p'`^6 * Psi * mu^2 * theta^4 - 12 * `p'`^6 * Psi * p^2 * theta^4 - 18 * `p'`^6 * Psi * mu^3 * theta^2 - 54 * `p'`^6 * Psi * p^3 * theta^2 + 36 * `p'`^4 * Psi^5 * mu^3 * omega^2 - 8 * `p'`^3 * Psi^5 * mu^2 * omega^4 - 8 * `p'`^3 * Psi^5 * omega^4 * p^2 + 108 * `p'`^4 * Psi^5 * omega^2 * p^3 - 144 * `p'`^5 * Psi^3 * mu^2 * omega^4 - 144 * `p'`^5 * Psi^3 * omega^4 * p^2 + 6 * `p'`^3 * Psi^5 * mu^3 * omega^2 + 18 * `p'`^3 * Psi^5 * omega^2 * p^3 + 36 * `p'`^5 * Psi^3 * mu^3 * omega^2 - 48 * `p'`^4 * Psi^3 * mu^2 * omega^4 - 4/3 * `p'`^4 * Psi^3 * mu^2 * theta^4 - 48 * `p'`^4 * Psi^3 * omega^4 * p^2 + 108 * `p'`^5 * Psi^3 * omega^2 * p^3 - 4/3 * `p'`^4 * Psi^3 * p^2 * theta^4 + 24 * `p'`^4 * Psi^3 * mu^3 * omega^2 - 4 * `p'`^4 * Psi^3 * mu^3 * theta^2 + 72 * `p'`^4 * Psi^3 * omega^2 * p^3 - 12 * `p'`^4 * Psi^3 * p^3 * theta^2 - 24 * `p'`^4 * Psi^3 * mu^3 * p - 66 * `p'`^4 * Psi^3 * mu^2 * p^2 - 72 * `p'`^4 * Psi^3 * mu * p^3 - 120 * `p'`^4 * Psi^7 * mu^2 * omega^4 - 120 * `p'`^4 * Psi^7 * omega^4 * p^2 - 20 * `p'`^3 * Psi^7 * mu^2 * omega^4 - 20 * `p'`^3 * Psi^7 * omega^4 * p^2 - 252 * `p'`^5 * Psi^5 * mu^2 * omega^4 - 252 * `p'`^5 * Psi^5 * omega^4 * p^2 - 180 * `p'`^4 * Psi^5 * mu^2 * omega^4 - 180 * `p'`^4 * Psi^5 * omega^4 * p^2 - 216 * `p'`^6 * Psi^3 * omega^4 * mu * p + 108 * `p'`^7 * Psi * omega^2 * theta^2 * mu^2 + 108 * `p'`^7 * Psi * omega^2 * theta^2 * p^2 - 96 * Psi^7 * mu^3 * omega^4 * `p''`^2 * p - 144 * Psi^7 * mu^2 * omega^4 * `p''`^2 * p^2 - 96 * Psi^7 * omega^4 * p^3 * `p''`^2 * mu + 216 * `p'`^7 * Psi * omega^2 * theta^2 * mu * p - 72 * `p'`^4 * Psi^3 * mu^3 * omega^2 * `p''` * theta^2 - 72 * `p'`^4 * Psi^3 * omega^2 * p^3 * `p''` * theta^2 - 216 * `p'`^4 * Psi^3 * mu^2 * omega^2 * `p''` * theta^2 * p - 216 * `p'`^4 * Psi^3 * mu * omega^2 * `p''` * theta^2 * p^2$

- 36 * `p'`^2 * Psi^5 * mu^2 * omega^2 * `p''` * theta^2 * p - 36 * `p'`^2 * Psi^5 * omega^2 * p^2 * `p''` * theta^2 * mu - 12 * `p'`^2 * Psi^6 * mu^3 * omega * `p'''` * omega[a] * omega[-A] - 12 * `p'`^2 * Psi^6 * omega * p^3 * `p'''` * omega[a] * omega[-A] - 18 * `p'`^2 * Psi^5 * mu^4 * omega^2 * `p''` - 54 * `p'`^2 * Psi^5 * omega^2 * p^4 * `p''` + 108 * `p'`^2 * Psi^7 * mu^3 * omega^4 * `p''` + 108 * `p'`^3 * Psi^5 * mu^3 * omega^4 * `p''` + 108 * `p'`^3 * Psi^5 * omega^4 * p^3 * `p''` + 8 * `p'` * Psi^7 * mu^3 * omega^4 * `p''` + 8 * `p'` * Psi^7 * omega^4 * p^3 * `p''` + 108 * `p'`^2 * Psi^7 * omega^4 * p^3 * `p''` + 72 * `p'`^2 * Psi^5 * mu^3 * omega^4 * `p''` + 72 * `p'`^2 * Psi^5 * omega^4 * p^3 * `p''` - 24 * Psi^7 * mu^4 * omega^4 * `p'''`^2 - 24 * Psi^7 * omega^4 * p^4 * `p'''`^2 - 108 * `p'`^6 * Psi^3 * omega^4 * mu^2 - 108 * `p'`^6 * Psi^3 * omega^4 * p^2 + 24 * `p'` * Psi^7 * mu^2 * omega^4 * p * `p''` + 24 * `p'` * Psi^7 * mu * omega^4 * p^2 * `p''` + 324 * `p'`^2 * Psi^7 * mu^2 * omega^4 * p * `p''` + 324 * `p'`^2 * Psi^7 * mu * omega^4 * p^2 * `p''` + 324 * `p'`^3 * Psi^5 * mu^2 * omega^4 * p * `p''` + 324 * `p'`^3 * Psi^5 * mu * omega^4 * p^2 * `p''` - 12 * `p'`^2 * Psi^5 * mu^3 * omega^2 * `p''` * theta^2 + 216 * `p'`^2 * Psi^5 * mu^2 * omega^4 * p * `p''` + 216 * `p'`^2 * Psi^5 * mu * omega^4 * p^2 * `p''` - 12 * `p'`^2 * Psi^5 * omega^2 * p^3 * `p''` * theta^2 - 108 * `p'`^2 * Psi^5 * mu^3 * omega^2 * p * `p''` - 216 * `p'`^2 * Psi^5 * mu^2 * omega^2 * p^2 * `p''` - 180 * `p'`^2 * Psi^5 * mu * omega^2 * p^3 * `p''` + 48 * `p'`^4 * Psi^6 * mu * omega * p * omega[a] * omega[-A] + 8 * `p'`^3 * Psi^6 * mu * omega * p * omega[a] * omega[-A] + 72 * `p'`^5 * Psi^4 * mu * omega * p * omega[a] * omega[-A] + 48 * `p'`^4 * Psi^4 * mu * omega * p * omega[a] * omega[-A] - 36 * `p'`^2 * Psi^6 * mu^2 * omega * `p'''` * omega[a] * omega[-A] * p - 36 * `p'`^2 * Psi^6 * omega * p^2 * `p'''` * omega[a] * omega[-A] * mu + 4 * `p'`^3 * Psi^6 * omega * p^2 * omega[a] * omega[-A] + 8 * `p'`^3 * Psi^5 * mu * omega^2 * p * theta^2 + 36 * `p'`^5 * Psi^4 * mu^2 * omega * omega[a] * omega[-A] + 36 * `p'`^5 * Psi^4 * omega * p^2 * omega[a] * omega[-A] + 96 * `p'`^5 * Psi^3 * mu * omega^2 * p * theta^2 + 24 * `p'`^4 * Psi^4 * mu^2 * omega * omega[a] * omega[-A] + 24 * `p'`^4 * Psi^4 * omega * p^2 * omega[a] * omega[-A] + 32 * `p'`^4 * Psi^3 * mu * omega^2 * p * theta^2 + 144 * `p'`^6 * Psi * mu * omega^2 * p * theta^2 + 24 * `p'`^4 * Psi^6 * mu^2 * omega * omega[a] * omega[-A] + 24 * `p'`^4 * Psi^6 * omega * p^2 * omega[a] * omega[-A] + 48 * `p'`^4 * Psi^5 * mu * omega^2 * p * theta^2 + 288 * `p'`^6 * Psi^3 * mu * omega^2 * p * theta^2 + 4 * `p'`^3 * Psi^6 * mu^2 * omega * omega[a] * omega[-A] + 144 * `p'`^6 * Psi^3 * mu^2 * omega^2 * theta^2 + 144 * `p'`^6 * Psi^3 * omega^2 * p^2 * theta^2 + 42 * `p'`^3 * Psi^5 * mu * omega^2 * p^2 + 180 * `p'`^5 * Psi^3 * mu^2 * omega^2 * p + 16 * `p'`^4 * Psi^3 * mu^2 * omega^2 * theta^2 − 96 * `p'`^4 * Psi^3 * mu * omega^4 * p + 252 * `p'`^5 * Psi^3 * mu * omega^2 * p^2 − 8/3 * `p'`^4 * Psi^3 * mu * p * theta^4 + 16 * `p'`^4 * Psi^3 * omega^2 * p^2 * theta^2 + 120 * `p'`^4 * Psi^3 * mu^2 * omega^2 * p − 20 * `p'`^4 * Psi^3 * mu^2 * p * theta^2 + 168 * `p'`^4 * Psi^3 * mu * omega^2 * p^2 − 28 * `p'`^4 * Psi^3 * mu * p^2 * theta^2 − 240 * `p'`^4 * Psi^7 * mu * omega^4 * p − 40 * `p'`^3 * Psi^7 * mu * omega^4 * p − 504 * `p'`^5 * Psi^5 * mu * omega^4 * p + 30 * `p'`^3 * Psi^5 * mu^2 * omega^2 * p + 72 * `p'`^6 * Psi * mu^2 * omega^2 * theta^2 − 24 * `p'`^6 * Psi * mu * p * theta^4 + 72 * `p'`^6 * Psi * omega^2 * p^2 * theta^2 − 90 * `p'`^6 * Psi * mu^2 * p * theta^2 − 126 * `p'`^6 * Psi * mu * p^2 * theta^2 + 180 * `p'`^4 * Psi^5 * mu^2 * omega^2 * p + 4 * `p'`^3 * Psi^5 * mu^2 * omega^2 * theta^2 − 16 * `p'`^3 * Psi^5 * mu * omega^4 * p + 252 * `p'`^4 * Psi^5 * mu * omega^2 * p^2 + 4 * `p'`^3 * Psi^5 * omega^2 * p^2 * theta^2 + 48 * `p'`^5 * Psi^3 * mu^2 * omega^2 * theta^2 − 288 * `p'`^5 * Psi^3 * mu * omega^4 * p + 48 * `p'`^5 * Psi^3 * omega^2 * p^2 * theta^2 + 24 * `p'`^4 * Psi^5 * mu^2 * omega^2 * theta^2 − 360 * `p'`^4 * Psi^5 * mu * omega^4 * p + 24 * `p'`^4 * Psi^5 * omega^2 * p^2 * theta^2 − 3 * `p'`^4 * Psi^3 * mu^4 − 27 * `p'`^4 * Psi^3 * p^4 = 0 : T(%);

$$-216\, p'^4\, \Psi^3\, \mu^2\, \omega^2\, p''\, \theta^2\, p - 216\, p'^4\, \Psi^3\, \mu\, \omega^2\, p''\, \theta^2\, p^2 - 36\, p'^2\, \Psi^5\, \mu^2\, \omega^2\, p''\, \theta^2\, p \tag{1.4}$$

$$- 36\, p'^2\, \Psi^5\, \omega^2\, p^2\, p''\, \theta^2\, \mu - 3\, p'^4\, \Psi^3\, \mu^4 - 27\, p'^4\, \Psi^3\, p^4 + 252\, p'^4\, \Psi^5\, \mu\, \omega^2\, p^2$$

$$+ 4\,p^3\,\Psi^5\,\omega^2\,p^2\,\theta^2 + 48\,p^5\,\Psi^3\,\mu^2\,\omega^2\,\theta^2 - 288\,p^5\,\Psi^3\,\mu\,\omega^4\,p + 48\,p^5\,\Psi^3\,\omega^2\,p^2\,\theta^2$$

$$+ 24\,p^4\,\Psi^5\,\mu^2\,\omega^2\,\theta^2 - 360\,p^4\,\Psi^5\,\mu\,\omega^4\,p + 108\,p^3\,\Psi^5\,\omega^4\,p^3\,p'' + 8\,p'\,\Psi^7\,\mu^3\,\omega^4\,p''$$

$$+ 8\,p'\,\Psi^7\,\omega^4\,p^3\,p'' + 108\,p^2\,\Psi^7\,\omega^4\,p^3\,p'' + 72\,p^2\,\Psi^5\,\mu^3\,\omega^4\,p'' + 72\,p^2\,\Psi^5\,\omega^4\,p^3\,p''$$

$$+ 144\,p^6\,\Psi^3\,\mu^2\,\omega^2\,\theta^2 + 144\,p^6\,\Psi^3\,\omega^2\,p^2\,\theta^2 + 42\,p^3\,\Psi^5\,\mu\,\omega^2\,p^2 + 180\,p^5\,\Psi^3\,\mu^2\,\omega^2\,p$$

$$+ 16\,p^4\,\Psi^3\,\mu^2\,\omega^2\,\theta^2 - 96\,p^4\,\Psi^3\,\mu\,\omega^4\,p + 252\,p^5\,\Psi^3\,\mu\,\omega^2\,p^2 - \frac{8}{3}\,p^4\,\Psi^3\,\mu\,p\,\theta^4$$

$$+ 16\,p^4\,\Psi^3\,\omega^2\,p^2\,\theta^2 + 120\,p^4\,\Psi^3\,\mu^2\,\omega^2\,p - 20\,p^4\,\Psi^3\,\mu^2\,p\,\theta^2 + 168\,p^4\,\Psi^3\,\mu\,\omega^2\,p^2$$

$$- 28\,p^4\,\Psi^3\,\mu\,p^2\,\theta^2 - 240\,p^4\,\Psi^7\,\mu\,\omega^4\,p - 40\,p^3\,\Psi^7\,\mu\,\omega^4\,p - 504\,p^5\,\Psi^5\,\mu\,\omega^4\,p$$

$$+ 30\,p^3\,\Psi^5\,\mu^2\,\omega^2\,p + 72\,p^6\,\Psi\,\mu^2\,\omega^2\,\theta^2 - 24\,p^6\,\Psi\,\mu\,p\,\theta^4 + 72\,p^6\,\Psi\,\omega^2\,p^2\,\theta^2$$

$$- 90\,p^6\,\Psi\,\mu^2\,p\,\theta^2 - 126\,p^6\,\Psi\,\mu\,p^2\,\theta^2 + 180\,p^4\,\Psi^5\,\mu^2\,\omega^2\,p + 4\,p^3\,\Psi^5\,\mu^2\,\omega^2\,\theta^2$$

$$- 16\,p^3\,\Psi^5\,\mu\,\omega^4\,p - 216\,p^6\,\Psi^3\,\omega^4\,\mu\,p + 108\,p^7\,\Psi\,\omega^2\,\theta^2\,\mu^2 + 108\,p^7\,\Psi\,\omega^2\,\theta^2\,p^2$$

$$- 96\,\Psi^7\,\mu^3\,\omega^4\,p'^2\,p - 144\,\Psi^7\,\mu^2\,\omega^4\,p'^2\,p^2 - 96\,\Psi^7\,\omega^4\,p^3\,p'^2\,\mu - 18\,p^2\,\Psi^5\,\mu^4\,\omega^2\,p''$$

$$- 54\,p^2\,\Psi^5\,\omega^2\,p^4\,p'' + 108\,p^2\,\Psi^7\,\mu^3\,\omega^4\,p'' + 108\,p^3\,\Psi^5\,\mu^3\,\omega^4\,p'' + 24\,p^4\,\Psi^5\,\omega^2\,p^2\,\theta^2$$

$$+ 24\,p'\,\Psi^7\,\mu^2\,\omega^4\,p\,p'' + 24\,p'\,\Psi^7\,\mu\,\omega^4\,p^2\,p'' + 324\,p^2\,\Psi^7\,\mu^2\,\omega^4\,p\,p''$$

$$+ 324\,p^2\,\Psi^7\,\mu\,\omega^4\,p^2\,p'' + 324\,p^3\,\Psi^5\,\mu^2\,\omega^4\,p\,p'' + 324\,p^3\,\Psi^5\,\mu\,\omega^4\,p^2\,p''$$

$$- 12\,p^2\,\Psi^5\,\mu^3\,\omega^2\,p''\,\theta^2 + 216\,p^2\,\Psi^5\,\mu^2\,\omega^4\,p\,p'' + 216\,p^2\,\Psi^5\,\mu\,\omega^4\,p^2\,p''$$

$$- 12\,p^2\,\Psi^5\,\omega^2\,p^3\,p''\,\theta^2 - 108\,p^2\,\Psi^5\,\mu^3\,\omega^2\,p\,p'' - 216\,p^2\,\Psi^5\,\mu^2\,\omega^2\,p^2\,p''$$

$$- 180\,p^2\,\Psi^5\,\mu\,\omega^2\,p^3\,p'' + 8\,p^3\,\Psi^5\,\mu\,\omega^2\,p\,\theta^2 + 96\,p^5\,\Psi^3\,\mu\,\omega^2\,p\,\theta^2 + 32\,p^4\,\Psi^3\,\mu\,\omega^2\,p\,\theta^2$$

$$+ 144\,p^6\,\Psi\,\mu\,\omega^2\,p\,\theta^2 + 48\,p^4\,\Psi^5\,\mu\,\omega^2\,p\,\theta^2 + 288\,p^6\,\Psi^3\,\mu\,\omega^2\,p\,\theta^2 + 216\,p^7\,\Psi\,\omega^2\,\theta^2\,\mu\,p$$

$$- 72\,p^4\,\Psi^3\,\mu^3\,\omega^2\,p''\,\theta^2 - 72\,p^4\,\Psi^3\,\omega^2\,p^3\,p''\,\theta^2 + 24\,p^4\,\Psi^6\,\mu^2\,\omega\,\omega^{\ a}\,\omega_{;a}$$

$$+ 36\,p^5\,\Psi^4\,\omega\,p^2\,\omega^{\ a}\,\omega_{;a} + 24\,p^4\,\Psi^4\,\omega\,p^2\,\omega^{\ a}\,\omega_{;a} + 24\,p^4\,\Psi^6\,\omega\,p^2\,\omega^{\ a}\,\omega_{;a}$$

$$+ 24\,p^4\,\Psi^4\,\mu^2\,\omega\,\omega^{\ a}\,\omega_{;a} + 36\,p^5\,\Psi^4\,\mu^2\,\omega\,\omega^{\ a}\,\omega_{;a} + 4\,p^3\,\Psi^6\,\omega\,p^2\,\omega^{\ a}\,\omega_{;a}$$

$$+ 4\,p^3\,\Psi^6\,\mu^2\,\omega\,\omega^{\ a}\,\omega_{;a} + 72\,p^4\,\Psi^3\,\omega^2\,p^3 - 12\,p^4\,\Psi^3\,p^3\,\theta^2 - 24\,p^4\,\Psi^3\,\mu^3\,p$$

$$- 66\,p^4\,\Psi^3\,\mu^2\,p^2 - 72\,p^4\,\Psi^3\,\mu\,p^3 - 120\,p^4\,\Psi^7\,\mu^2\,\omega^4 - 120\,p^4\,\Psi^7\,\omega^4\,p^2$$

$$- 20\,p^3\,\Psi^7\,\mu^2\,\omega^4 - 20\,p^3\,\Psi^7\,\omega^4\,p^2 - 252\,p^5\,\Psi^5\,\mu^2\,\omega^4 - 252\,p^5\,\Psi^5\,\omega^4\,p^2$$

$$- 180\,p^4\,\Psi^5\,\mu^2\,\omega^4 - 180\,p^4\,\Psi^5\,\omega^4\,p^2 - 24\,\Psi^7\,\mu^4\,\omega^4\,p'^2 - 24\,\Psi^7\,\omega^4\,p^4\,p'^2$$

$$- 108\,p^6\,\Psi^3\,\omega^4\,\mu^2 - 108\,p^6\,\Psi^3\,\omega^4\,p^2 - 12\,p^6\,\Psi\,\mu^2\,\theta^4 - 12\,p^6\,\Psi\,p^2\,\theta^4 - 18\,p^6\,\Psi\,\mu^3\,\theta^2$$

$$-54 p^6 \Psi p^3 \theta^2 + 36 p^4 \Psi^5 \mu^3 \omega^2 - 8 p^3 \Psi^5 \mu^2 \omega^4 - 8 p^3 \Psi^5 \omega^4 p^2 + 108 p^4 \Psi^5 \omega^2 p^3$$

$$-144 p^5 \Psi^3 \mu^2 \omega^4 - 144 p^5 \Psi^3 \omega^4 p^2 + 6 p^3 \Psi^5 \mu^3 \omega^2 + 18 p^3 \Psi^5 \omega^2 p^3$$

$$+36 p^5 \Psi^3 \mu^3 \omega^2 - 48 p^4 \Psi^3 \mu^2 \omega^4 - \frac{4}{3} p^4 \Psi^3 \mu^2 \theta^4 - 48 p^4 \Psi^3 \omega^4 p^2$$

$$+108 p^5 \Psi^3 \omega^2 p^3 - \frac{4}{3} p^4 \Psi^3 p^2 \theta^4 + 24 p^4 \Psi^3 \mu^3 \omega^2 - 4 p^4 \Psi^3 \mu^3 \theta^2$$

$$-36 p^2 \Psi^6 \mu^2 \omega p'' \omega^a \omega_{;a} p - 36 p^2 \Psi^6 \omega p^2 p'' \omega^a \omega_{;a} \mu + 8 p^3 \Psi^6 \mu \omega p \omega^a \omega_{;a}$$

$$+72 p^5 \Psi^4 \mu \omega p \omega^a \omega_{;a} + 48 p^4 \Psi^4 \mu \omega p \omega^a \omega_{;a} - 12 p^2 \Psi^6 \mu^3 \omega p'' \omega^a \omega_{;a}$$

$$-12 p^2 \Psi^6 \omega p^3 p'' \omega^a \omega_{;a} + 48 p^4 \Psi^6 \mu \omega p \omega^a \omega_{;a} = 0$$

```
>
```

Here we contract temp3 with omega[a,b] and use temp2

```
> convert(temp2, string);
```

$$\text{"omega*omega[-A]*omega[a,b] = 0"} \tag{1.5}$$

```
> temp4 := expand(omega[a, b]·temp3) : T(%);
```

$$24\, \omega^{ab} p^4 \Psi^6 \omega p^2 \omega^a \omega_{;a} + 4\, \omega^{ab} p^3 \Psi^6 \mu^2 \omega \omega^a \omega_{;a} + 4\, \omega^{ab} p^3 \Psi^6 \omega p^2 \omega^a \omega_{;a} \tag{1.6}$$

$$+36\, \omega^{ab} p^5 \Psi^4 \mu^2 \omega \omega^a \omega_{;a} + 36\, \omega^{ab} p^5 \Psi^4 \omega p^2 \omega^a \omega_{;a}$$

$$+24\, \omega^{ab} p^4 \Psi^4 \mu^2 \omega \omega^a \omega_{;a} + 24\, \omega^{ab} p^4 \Psi^4 \omega p^2 \omega^a \omega_{;a}$$

$$+24\, \omega^{ab} p^4 \Psi^6 \mu^2 \omega \omega^a \omega_{;a} + 48\, \omega^{ab} p^4 \Psi^4 \mu \omega p \omega^a \omega_{;a}$$

$$-12\, \omega^{ab} p^2 \Psi^6 \mu^3 \omega p'' \omega^a \omega_{;a} + 48\, \omega^{ab} p^4 \Psi^6 \mu \omega p \omega^a \omega_{;a}$$

$$-12\, \omega^{ab} p^2 \Psi^6 \omega p^3 p'' \omega^a \omega_{;a} + 8\, \omega^{ab} p^3 \Psi^6 \mu \omega p \omega^a \omega_{;a}$$

$$+72\, \omega^{ab} p^5 \Psi^4 \mu \omega p \omega^a \omega_{;a} - 180\, \omega^{ab} p^4 \Psi^5 \omega^4 p^2 - 24\, \omega^{ab} \Psi^7 \mu^4 \omega^4 p''^2$$

$$-24\, \omega^{ab} \Psi^7 \omega^4 p^4 p''^2 - 108\, \omega^{ab} p^6 \Psi^3 \omega^4 \mu^2 - 108\, \omega^{ab} p^6 \Psi^3 \omega^4 p^2$$

$$-12\, \omega^{ab} p^6 \Psi \mu^2 \theta^4 - 12\, \omega^{ab} p^6 \Psi p^2 \theta^4 - 18\, \omega^{ab} p^6 \Psi \mu^3 \theta^2$$

$$-54\, \omega^{ab} p^6 \Psi p^3 \theta^2 + 36\, \omega^{ab} p^4 \Psi^5 \mu^3 \omega^2 - 8\, \omega^{ab} p^3 \Psi^5 \mu^2 \omega^4$$

$$-8\, \omega^{ab} p^3 \Psi^5 \omega^4 p^2 + 108\, \omega^{ab} p^4 \Psi^5 \omega^2 p^3 - 144\, \omega^{ab} p^5 \Psi^3 \mu^2 \omega^4$$

$$-144\, \omega^{ab} p^5 \Psi^3 \omega^4 p^2 + 6\, \omega^{ab} p^3 \Psi^5 \mu^3 \omega^2 + 18\, \omega^{ab} p^3 \Psi^5 \omega^2 p^3$$

$$+36\, \omega^{ab} p^5 \Psi^3 \mu^3 \omega^2 - 48\, \omega^{ab} p^4 \Psi^3 \mu^2 \omega^4 - \frac{4}{3}\, \omega^{ab} p^4 \Psi^3 \mu^2 \theta^4$$

$$-48\, \omega^{ab} p^4 \Psi^3 \omega^4 p^2 + 108\, \omega^{ab} p^5 \Psi^3 \omega^2 p^3 - \frac{4}{3}\, \omega^{ab} p^4 \Psi^3 p^2 \theta^4$$

$$+\,24\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^3\,\omega^2 - 4\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^3\,\theta^2 + 72\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\omega^2\,p^3$$

$$-\,12\,\omega^{\,a\;b}\,p^4\,\Psi^3\,p^3\,\theta^2 - 24\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^3\,p - 66\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^2\,p^2$$

$$-\,72\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu\,p^3 - 120\,\omega^{\,a\;b}\,p^4\,\Psi^7\,\mu^2\,\omega^4 - 120\,\omega^{\,a\;b}\,p^4\,\Psi^7\,\omega^4\,p^2$$

$$-\,20\,\omega^{\,a\;b}\,p^3\,\Psi^7\,\mu^2\,\omega^4 - 20\,\omega^{\,a\;b}\,p^3\,\Psi^7\,\omega^4\,p^2 - 252\,\omega^{\,a\;b}\,p^5\,\Psi^5\,\mu^2\,\omega^4$$

$$-\,252\,\omega^{\,a\;b}\,p^5\,\Psi^5\,\omega^4\,p^2 - 180\,\omega^{\,a\;b}\,p^4\,\Psi^5\,\mu^2\,\omega^4 + 144\,\omega^{\,a\;b}\,p^6\,\Psi^3\,\omega^2\,p^2\,\theta^2$$

$$+\,42\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\mu\,\omega^2\,p^2 - 90\,\omega^{\,a\;b}\,p^6\,\Psi\,\mu^2\,p\,\theta^2 - 126\,\omega^{\,a\;b}\,p^6\,\Psi\,\mu\,p^2\,\theta^2$$

$$+\,180\,\omega^{\,a\;b}\,p^4\,\Psi^5\,\mu^2\,\omega^2\,p + 4\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\mu^2\,\omega^2\,\theta^2 - 16\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\mu\,\omega^4\,p$$

$$-\,216\,\omega^{\,a\;b}\,p^6\,\Psi^3\,\omega^4\,\mu\,p + 108\,\omega^{\,a\;b}\,p^7\,\Psi\,\omega^2\,\theta^2\,\mu^2 + 108\,\omega^{\,a\;b}\,p^7\,\Psi\,\omega^2\,\theta^2\,p^2$$

$$-\,96\,\omega^{\,a\;b}\,\Psi^7\,\mu^3\,\omega^4\,p''^2\,p - 144\,\omega^{\,a\;b}\,\Psi^7\,\mu^2\,\omega^4\,p''^2\,p^2 - 96\,\omega^{\,a\;b}\,\Psi^7\,\omega^4\,p^3\,p''^2\,\mu$$

$$-\,18\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu^4\,\omega^2\,p'' - 54\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\omega^2\,p^4\,p'' + 108\,\omega^{\,a\;b}\,p^2\,\Psi^7\,\mu^3\,\omega^4\,p''$$

$$+\,108\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\mu^3\,\omega^4\,p'' + 24\,\omega^{\,a\;b}\,p^4\,\Psi^5\,\omega^2\,p^2\,\theta^2 + 252\,\omega^{\,a\;b}\,p^4\,\Psi^5\,\mu\,\omega^2\,p^2$$

$$+\,4\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\omega^2\,p^2\,\theta^2 + 48\,\omega^{\,a\;b}\,p^5\,\Psi^3\,\mu^2\,\omega^2\,\theta^2 - 288\,\omega^{\,a\;b}\,p^5\,\Psi^3\,\mu\,\omega^4\,p$$

$$+\,48\,\omega^{\,a\;b}\,p^5\,\Psi^3\,\omega^2\,p^2\,\theta^2 + 24\,\omega^{\,a\;b}\,p^4\,\Psi^5\,\mu^2\,\omega^2\,\theta^2 - 360\,\omega^{\,a\;b}\,p^4\,\Psi^5\,\mu\,\omega^4\,p$$

$$+\,108\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\omega^4\,p^3\,p'' + 8\,\omega^{\,a\;b}\,p'\,\Psi^7\,\mu^3\,\omega^4\,p'' + 8\,\omega^{\,a\;b}\,p'\,\Psi^7\,\omega^4\,p^3\,p''$$

$$+\,108\,\omega^{\,a\;b}\,p^2\,\Psi^7\,\omega^4\,p^3\,p'' + 72\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu^3\,\omega^4\,p'' + 72\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\omega^4\,p^3\,p''$$

$$+\,144\,\omega^{\,a\;b}\,p^6\,\Psi^3\,\mu^2\,\omega^2\,\theta^2 + 180\,\omega^{\,a\;b}\,p^5\,\Psi^3\,\mu^2\,\omega^2\,p + 16\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^2\,\omega^2\,\theta^2$$

$$-\,96\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu\,\omega^4\,p + 252\,\omega^{\,a\;b}\,p^5\,\Psi^3\,\mu\,\omega^2\,p^2 - \frac{8}{3}\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu\,p\,\theta^4$$

$$+\,16\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\omega^2\,p^2\,\theta^2 + 120\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^2\,\omega^2\,p - 20\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^2\,p\,\theta^2$$

$$+\,168\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu\,\omega^2\,p^2 - 28\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu\,p^2\,\theta^2 - 240\,\omega^{\,a\;b}\,p^4\,\Psi^7\,\mu\,\omega^4\,p$$

$$-\,40\,\omega^{\,a\;b}\,p^3\,\Psi^7\,\mu\,\omega^4\,p - 504\,\omega^{\,a\;b}\,p^5\,\Psi^5\,\mu\,\omega^4\,p + 30\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\mu^2\,\omega^2\,p$$

$$+\,72\,\omega^{\,a\;b}\,p^6\,\Psi\,\mu^2\,\omega^2\,\theta^2 - 24\,\omega^{\,a\;b}\,p^6\,\Psi\,\mu\,p\,\theta^4 + 72\,\omega^{\,a\;b}\,p^6\,\Psi\,\omega^2\,p^2\,\theta^2$$

$$-\,3\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^4 - 27\,\omega^{\,a\;b}\,p^4\,\Psi^3\,p^4 - 216\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^2\,\omega^2\,p''\,\theta^2\,p$$

$$-\,36\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\omega^2\,p^2\,p''\,\theta^2\,\mu - 36\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu^2\,\omega^2\,p''\,\theta^2\,p$$

$$-\,216\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu\,\omega^2\,p''\,\theta^2\,p^2 - 36\,\omega^{\,a\;b}\,p^2\,\Psi^6\,\omega\,p^2\,p''\,\omega^{\,a}\,\omega_{;a}\,\mu$$

$$-\,36\,\omega^{\,a\;b}\,p^2\,\Psi^6\,\mu^2\,\omega\,p''\,\omega^{\,a}\,\omega_{;a}\,p + 324\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\mu^2\,\omega^4\,p\,p''$$

$$+\,324\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\mu\,\omega^4\,p^2\,p'' - 12\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu^3\,\omega^2\,p''\,\theta^2$$

$$+\,216\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu^2\,\omega^4\,p\,p'' + 216\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu\,\omega^4\,p^2\,p''$$

$$-12\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\omega^2\,p^3\,p''\,\theta^2 - 108\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu^3\,\omega^2\,p\,p''$$

$$-216\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu^2\,\omega^2\,p^2\,p'' - 180\,\omega^{\,a\;b}\,p^2\,\Psi^5\,\mu\,\omega^2\,p^3\,p'' + 8\,\omega^{\,a\;b}\,p^3\,\Psi^5\,\mu\,\omega^2\,p\,\theta^2$$

$$+96\,\omega^{\,a\;b}\,p^5\,\Psi^3\,\mu\,\omega^2\,p\,\theta^2 + 32\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu\,\omega^2\,p\,\theta^2 + 144\,\omega^{\,a\;b}\,p^6\,\Psi\,\mu\,\omega^2\,p\,\theta^2$$

$$+48\,\omega^{\,a\;b}\,p^4\,\Psi^5\,\mu\,\omega^2\,p\,\theta^2 + 288\,\omega^{\,a\;b}\,p^6\,\Psi^3\,\mu\,\omega^2\,p\,\theta^2 + 216\,\omega^{\,a\;b}\,p^7\,\Psi\,\omega^2\,\theta^2\,\mu\,p$$

$$-72\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\mu^3\,\omega^2\,p''\,\theta^2 - 72\,\omega^{\,a\;b}\,p^4\,\Psi^3\,\omega^2\,p^3\,p''\,\theta^2 + 24\,\omega^{\,a\;b}\,p'\,\Psi^7\,\mu^2\,\omega^4\,p\,p''$$

$$+24\,\omega^{\,a\;b}\,p'\,\Psi^7\,\mu\,\omega^4\,p^2\,p'' + 324\,\omega^{\,a\;b}\,p^2\,\Psi^7\,\mu^2\,\omega^4\,p\,p'' + 324\,\omega^{\,a\;b}\,p^2\,\Psi^7\,\mu\,\omega^4\,p^2\,p''$$

$$= 0$$

```
> #temp5:=TEDS(temp2, op(7, op(1, temp4))) : T(%);
```

```
> #nops(op(1, temp4));
```

```
> #op(89, op(1, temp4));
```

```
>
```

```
> #for i from 1 to nops(op(1, temp4)) do
  # print(i, TEDS(temp2, op(i, op(1, temp4))));
  # end do;
```

>
>
>
>
>
>

subs temp3 into temp4

> $temp5 := collect\left(expand\left(TEDS\left(PU = p + \text{mu}, -\frac{3 \cdot TEDS(temp, temp4)}{`p'`^4 \cdot \text{Psi}} \right) \right), [\Psi, `p'`] \right) :$
>
> $T(\%);$

$$\left(360 \, \omega^{a \, b} \mu^2 \omega^4 + 720 \, \omega^{a \, b} \mu \omega^4 p + 360 \, \omega^{a \, b} \omega^4 p^2 \right. \qquad \textbf{(1.7)}$$

$$+ \frac{60 \, \omega^{a \, b} \mu^2 \omega^4 + 120 \, \omega^{a \, b} \mu \omega^4 p + 60 \, \omega^{a \, b} \omega^4 p^2}{p'}$$

$$+ \frac{1}{p'^2} \left(-324 \, \omega^{a \, b} \mu^3 \omega^4 p'' - 972 \, \omega^{a \, b} \mu^2 \omega^4 p \, p'' - 972 \, \omega^{a \, b} \mu \omega^4 p^2 p'' \right.$$

$$\left. - 324 \, \omega^{a \, b} \omega^4 p^3 p'' \right)$$

$$+ \frac{1}{p'^3} \left(-24 \, \omega^{a \, b} \mu^3 \omega^4 p'' - 72 \, \omega^{a \, b} \mu^2 \omega^4 p \, p'' - 72 \, \omega^{a \, b} \mu \omega^4 p^2 p'' \right.$$

$$\left. - 24 \, \omega^{a \, b} \omega^4 p^3 p'' \right) + \frac{1}{p'^4} \left(72 \, \omega^{a \, b} \mu^4 \omega^4 p'^2 + 288 \, \omega^{a \, b} \mu^3 \omega^4 p'^2 p \right.$$

$$\left. + 432 \, \omega^{a \, b} \mu^2 \omega^4 p'^2 p^2 + 288 \, \omega^{a \, b} \omega^4 p^3 p'^2 \mu + 72 \, \omega^{a \, b} \omega^4 p^4 p'^2 \right) \right) \Psi^6 + \left(\vphantom{\frac{1}{2}} \right.$$

$$-72 \, \omega^{a \, b} \mu^2 \omega \omega^a \omega_{;a} - 144 \, \omega^{a \, b} \mu \omega p \, \omega^a \omega_{;a} - 72 \, \omega^{a \, b} \omega p^2 \omega^a \omega_{;a}$$

$$+ \frac{-12 \, \omega^{a \, b} \mu^2 \omega \omega^a \omega_{;a} - 24 \, \omega^{a \, b} \mu \omega p \, \omega^a \omega_{;a} - 12 \, \omega^{a \, b} \omega p^2 \omega^a \omega_{;a}}{p'}$$

$$+ \frac{1}{p'^2} \left(36 \, \omega^{a \, b} \mu^3 \omega p'' \omega^a \omega_{;a} + 108 \, \omega^{a \, b} \mu^2 \omega p'' \omega^a \omega_{;a} p \right.$$

$$\left. + 108 \, \omega^{a \, b} \omega p^2 p'' \omega^a \omega_{;a} \mu + 36 \, \omega^{a \, b} \omega p^3 p'' \omega^a \omega_{;a} \right) \Psi^5 + \left(\left(756 \, \omega^{a \, b} \mu^2 \omega^4 \right. \right.$$

$$+ 1512\,\omega^{a\,b}\mu\omega^4 p + 756\,\omega^{a\,b}\omega^4 p^2\big)\,p' + 540\,\omega^{a\,b}\mu^2\omega^4 - 72\,\omega^{a\,b}\mu^2\omega^2\theta^2$$

$$+ 1080\,\omega^{a\,b}\mu\omega^4 p - 144\,\omega^{a\,b}\mu\omega^2 p\theta^2 + 540\,\omega^{a\,b}\omega^4 p^2 - 72\,\omega^{a\,b}\omega^2 p^2\theta^2$$

$$- 108\,\omega^{a\,b}\mu^3\omega^2 - 540\,\omega^{a\,b}\mu^2\omega^2 p - 756\,\omega^{a\,b}\mu\omega^2 p^2 - 324\,\omega^{a\,b}\omega^2 p^3$$

$$+ \frac{1}{p'}\big(-324\,\omega^{a\,b}\mu^3\omega^4 p'' - 972\,\omega^{a\,b}\mu^2\omega^4 p\,p'' - 972\,\omega^{a\,b}\mu\omega^4 p^2 p''$$

$$- 324\,\omega^{a\,b}\omega^4 p^3 p'' + 24\,\omega^{a\,b}\mu^2\omega^4 - 12\,\omega^{a\,b}\mu^2\omega^2\theta^2 + 48\,\omega^{a\,b}\mu\omega^4 p$$

$$- 24\,\omega^{a\,b}\mu\omega^2 p\theta^2 + 24\,\omega^{a\,b}\omega^4 p^2 - 12\,\omega^{a\,b}\omega^2 p^2\theta^2 - 18\,\omega^{a\,b}\mu^3\omega^2$$

$$- 90\,\omega^{a\,b}\mu^2\omega^2 p - 126\,\omega^{a\,b}\mu\omega^2 p^2 - 54\,\omega^{a\,b}\omega^2 p^3\big) + \frac{1}{p^2}\big($$

$$-216\,\omega^{a\,b}\mu^3\omega^4 p'' + 36\,\omega^{a\,b}\mu^3\omega^2 p''\theta^2 - 648\,\omega^{a\,b}\mu^2\omega^4 p\,p''$$

$$+ 108\,\omega^{a\,b}\mu^2\omega^2 p''\theta^2 p - 648\,\omega^{a\,b}\mu\omega^4 p^2 p'' + 108\,\omega^{a\,b}\mu\omega^2 p''\theta^2 p^2$$

$$- 216\,\omega^{a\,b}\omega^4 p^3 p'' + 36\,\omega^{a\,b}\omega^2 p^3 p''\theta^2 + 54\,\omega^{a\,b}\mu^4\omega^2 p''$$

$$+ 324\,\omega^{a\,b}\mu^3\omega^2 p\,p'' + 648\,\omega^{a\,b}\mu^2\omega^2 p^2 p'' + 540\,\omega^{a\,b}\mu\omega^2 p^3 p''$$

$$+ 162\,\omega^{a\,b}\omega^2 p^4 p''\big)\big)\Psi^4 + \big(\big(-108\,\omega^{a\,b}\mu^2\omega\omega^a\omega_{;a} - 216\,\omega^{a\,b}\mu\omega p\omega^a\omega_{;a}$$

$$- 108\,\omega^{a\,b}\omega p^2\omega^a\omega_{;a}\big)p' - 72\,\omega^{a\,b}\mu^2\omega\omega^a\omega_{;a} - 144\,\omega^{a\,b}\mu\omega p\omega^a\omega_{;a}$$

$$- 72\,\omega^{a\,b}\omega p^2\omega^a\omega_{;a}\big)\Psi^3 + \big(648\,\omega^{a\,b}\mu^2\omega^2 p''\theta^2 p + 648\,\omega^{a\,b}\mu\omega^2 p''\theta^2 p^2$$

$$- 96\,\omega^{a\,b}\mu\omega^2 p\theta^2 + 216\,\omega^{a\,b}\mu^3\omega^2 p''\theta^2 + 216\,\omega^{a\,b}\omega^2 p^3 p''\theta^2$$

$$+ 144\,\omega^{a\,b}\mu^2\omega^4 + 144\,\omega^{a\,b}\omega^4 p^2 - 72\,\omega^{a\,b}\mu^3\omega^2 - 216\,\omega^{a\,b}\omega^2 p^3$$

$$+ 4\,\omega^{a\,b}\mu^2\theta^4 + 4\,\omega^{a\,b}p^2\theta^4 + 12\,\omega^{a\,b}\mu^3\theta^2 + 36\,\omega^{a\,b}p^3\theta^2 + 72\,\omega^{a\,b}\mu^3 p$$

$$+ 198\,\omega^{a\,b}\mu^2 p^2 + 216\,\omega^{a\,b}\mu p^3 + \big(432\,\omega^{a\,b}\mu^2\omega^4 - 144\,\omega^{a\,b}\mu^2\omega^2\theta^2$$

$$+ 864\,\omega^{a\,b}\mu\omega^4 p - 288\,\omega^{a\,b}\mu\omega^2 p\theta^2 + 432\,\omega^{a\,b}\omega^4 p^2 - 144\,\omega^{a\,b}\omega^2 p^2\theta^2$$

$$- 108\,\omega^{a\,b}\mu^3\omega^2 - 540\,\omega^{a\,b}\mu^2\omega^2 p - 756\,\omega^{a\,b}\mu\omega^2 p^2 - 324\,\omega^{a\,b}\omega^2 p^3\big)p'$$

$$+ \big(324\,\omega^{a\,b}\mu^2\omega^4 - 432\,\omega^{a\,b}\mu^2\omega^2\theta^2 + 648\,\omega^{a\,b}\mu\omega^4 p - 864\,\omega^{a\,b}\mu\omega^2 p\theta^2$$

$$+ 324\,\omega^{a\,b}\omega^4 p^2 - 432\,\omega^{a\,b}\omega^2 p^2\theta^2\big)p^2 + 9\,\omega^{a\,b}\mu^4 + 81\,\omega^{a\,b}p^4$$

$$+ 288\, \omega^{a\,b}\, \mu\, \omega^4 p - 48\, \omega^{a\,b}\, \mu^2\, \omega^2 \theta^2 - 48\, \omega^{a\,b}\, \omega^2 p^2 \theta^2 - 360\, \omega^{a\,b}\, \mu^2\, \omega^2 p$$

$$- 504\, \omega^{a\,b}\, \mu\, \omega^2 p^2 + 8\, \omega^{a\,b}\, \mu\, p\, \theta^4 + 60\, \omega^{a\,b}\, \mu^2\, p\, \theta^2 + 84\, \omega^{a\,b}\, \mu\, p^2 \theta^2 \Big) \Psi^2 + \Big($$

$$-324\, \omega^{a\,b}\, \mu^2\, \omega^2 \theta^2 - 648\, \omega^{a\,b}\, \mu\, \omega^2 p\, \theta^2 - 324\, \omega^{a\,b}\, \omega^2 p^2 \theta^2 \Big) p^3 + \Big($$

$$-216\, \omega^{a\,b}\, \mu^2\, \omega^2 \theta^2 + 36\, \omega^{a\,b}\, \mu^2\, \theta^4 - 432\, \omega^{a\,b}\, \mu\, \omega^2 p\, \theta^2 + 72\, \omega^{a\,b}\, \mu\, p\, \theta^4$$

$$- 216\, \omega^{a\,b}\, \omega^2 p^2 \theta^2 + 36\, \omega^{a\,b}\, p^2 \theta^4 + 54\, \omega^{a\,b}\, \mu^3\, \theta^2 + 270\, \omega^{a\,b}\, \mu^2\, p\, \theta^2$$

$$+ 378\, \omega^{a\,b}\, \mu\, p^2 \theta^2 + 162\, \omega^{a\,b}\, p^3 \theta^2 \Big) p^2 = 0$$

```
> op(1, lhs(temp5));
```

$$\Bigg(360\, \omega_{a,\,b}\, \mu^2\, \omega^4 + 720\, \omega_{a,\,b}\, \mu\, \omega^4 p + 360\, \omega_{a,\,b}\, \omega^4 p^2 \tag{1.8}$$

$$+ \frac{60\, \mu^2\, \omega^4\, \omega_{a,\,b} + 120\, \mu\, \omega^4 p\, \omega_{a,\,b} + 60\, \omega^4 p^2\, \omega_{a,\,b}}{p'}$$

$$+ \frac{-324\, \mu^3\, \omega^4\, p''\, \omega_{a,\,b} - 972\, \mu^2\, \omega^4 p\, p''\, \omega_{a,\,b} - 972\, \mu\, \omega^4 p^2\, p''\, \omega_{a,\,b} - 324\, \omega^4 p^3\, p''\, \omega_{a,\,b}}{p^2}$$

$$+ \frac{-24\, \mu^3\, \omega^4\, p''\, \omega_{a,\,b} - 72\, \mu^2\, \omega^4 p\, p''\, \omega_{a,\,b} - 72\, \mu\, \omega^4 p^2\, p''\, \omega_{a,\,b} - 24\, \omega^4 p^3\, p''\, \omega_{a,\,b}}{p^3}$$

$$+ \frac{1}{p^4} \Big(72\, \mu^4\, \omega^4\, p'^2\, \omega_{a,\,b} + 288\, \mu^3\, \omega^4 p\, p'^2\, \omega_{a,\,b} + 432\, \mu^2\, \omega^4 p^2\, p'^2\, \omega_{a,\,b}$$

$$+ 288\, \mu\, \omega^4 p^3\, p'^2\, \omega_{a,\,b} + 72\, \omega^4 p^4\, p'^2\, \omega_{a,\,b} \Big) \Bigg) \Psi^6$$

```
> op(2, lhs(temp5));
```

$$\Bigg(-72\, \omega_{a,\,b}\, \mu^2\, \omega\, \omega_a\, \omega_{-A} - 144\, \omega_{a,\,b}\, \mu\, \omega\, p\, \omega_a\, \omega_{-A} - 72\, \omega_{a,\,b}\, \omega\, p^2\, \omega_a\, \omega_{-A} \tag{1.9}$$

$$+ \frac{-12\, \mu^2\, \omega\, \omega_a\, \omega_{-A}\, \omega_{a,\,b} - 24\, \mu\, \omega\, p\, \omega_a\, \omega_{-A}\, \omega_{a,\,b} - 12\, \omega\, p^2\, \omega_a\, \omega_{-A}\, \omega_{a,\,b}}{p'}$$

$$+ \frac{1}{p^2} \Big(36\, \mu^3\, \omega\, p''\, \omega_a\, \omega_{-A}\, \omega_{a,\,b} + 108\, \mu^2\, \omega\, p\, p''\, \omega_a\, \omega_{-A}\, \omega_{a,\,b}$$

$$+ 108\, \mu\, \omega\, p^2\, p''\, \omega_a\, \omega_{-A}\, \omega_{a,\,b} + 36\, \omega\, p^3\, p''\, \omega_a\, \omega_{-A}\, \omega_{a,\,b} \Big) \Bigg) \Psi^5$$

```
> op(3, lhs(temp5));
```

$$\Bigg(\Big(756\, \mu^2\, \omega^4\, \omega_{a,\,b} + 1512\, \mu\, \omega^4 p\, \omega_{a,\,b} + 756\, \omega^4 p^2\, \omega_{a,\,b} \Big) p' + 540\, \omega_{a,\,b}\, \mu^2\, \omega^4 \tag{1.10}$$

$$-72\,\omega_{a,\,b}\,\mu^2\,\omega^2\,\theta^2 + 1080\,\omega_{a,\,b}\,\mu\,\omega^4\,p - 144\,\omega_{a,\,b}\,\mu\,\omega^2\,p\,\theta^2 + 540\,\omega_{a,\,b}\,\omega^4\,p^2$$

$$-72\,\omega_{a,\,b}\,\omega^2\,p^2\,\theta^2 - 108\,\omega_{a,\,b}\,\mu^3\,\omega^2 - 540\,\omega_{a,\,b}\,\mu^2\,\omega^2\,p - 756\,\omega_{a,\,b}\,\mu\,\omega^2\,p^2$$

$$-324\,\omega_{a,\,b}\,\omega^2\,p^3 + \frac{1}{p'}\left(-324\,\mu^3\,\omega^4\,p''\,\omega_{a,\,b} - 972\,\mu^2\,\omega^4\,p\,p''\,\omega_{a,\,b}\right.$$

$$-972\,\mu\,\omega^4\,p^2\,p''\,\omega_{a,\,b} - 324\,\omega^4\,p^3\,p''\,\omega_{a,\,b} + 24\,\mu^2\,\omega^4\,\omega_{a,\,b} - 12\,\mu^2\,\omega^2\,\theta^2\,\omega_{a,\,b}$$

$$+48\,\mu\,\omega^4\,p\,\omega_{a,\,b} - 24\,\mu\,\omega^2\,p\,\theta^2\,\omega_{a,\,b} + 24\,\omega^4\,p^2\,\omega_{a,\,b} - 12\,\omega^2\,p^2\,\theta^2\,\omega_{a,\,b}$$

$$-18\,\mu^3\,\omega^2\,\omega_{a,\,b} - 90\,\mu^2\,\omega^2\,p\,\omega_{a,\,b} - 126\,\mu\,\omega^2\,p^2\,\omega_{a,\,b} - 54\,\omega^2\,p^3\,\omega_{a,\,b}\left.\right) + \frac{1}{p^2}\left(\right.$$

$$-216\,\mu^3\,\omega^4\,p''\,\omega_{a,\,b} + 36\,\mu^3\,\omega^2\,p''\,\theta^2\,\omega_{a,\,b} - 648\,\mu^2\,\omega^4\,p\,p''\,\omega_{a,\,b} + 108\,\mu^2\,\omega^2\,p\,p''\,\theta^2\,\omega_{a,\,b}$$

$$-648\,\mu\,\omega^4\,p^2\,p''\,\omega_{a,\,b} + 108\,\mu\,\omega^2\,p^2\,p''\,\theta^2\,\omega_{a,\,b} - 216\,\omega^4\,p^3\,p''\,\omega_{a,\,b}$$

$$+36\,\omega^2\,p^3\,p''\,\theta^2\,\omega_{a,\,b} + 54\,\mu^4\,\omega^2\,p''\,\omega_{a,\,b} + 324\,\mu^3\,\omega^2\,p\,p''\,\omega_{a,\,b} + 648\,\mu^2\,\omega^2\,p^2\,p''\,\omega_{a,\,b}$$

$$+540\,\mu\,\omega^2\,p^3\,p''\,\omega_{a,\,b} + 162\,\omega^2\,p^4\,p''\,\omega_{a,\,b}\left.\right)\left.\right)\Psi^4$$

This proof of eq74a is incomplete

> $eq[74\,a] := 2 \cdot \dfrac{\text{`}p'\text{`}}{\text{Psi}} \cdot omega[a] \cdot omega \cdot omega[-A] = 4 \cdot \left(\text{`}p'\text{`} - \dfrac{2}{3}\right) \cdot \omega^4 : T(\%);$

$$\frac{2\,p'\,\omega^{\,a}\,\omega\,\omega_{;a}}{\Psi} = 4\left(p' - \frac{2}{3}\right)\omega^4 \tag{1.11}$$

> $eq[74\,b] := temp2 : T(\%);$

$$\omega\,\omega_{;a}\,\omega^{\,a\,b} = 0 \tag{1.12}$$

>